PROCEEDINGS OF THE BROWN COUNTY
HUMAN SERVICES COMMITTEE

Pursuant to Section 19.84 Wis. Stats., a regular meeting of the **Brown County Human Services Committee** was held on Wednesday, June 27, 2018 in Room 200 of the Northern Building, 305 E. Walnut Street, Green Bay, WI.

Present: Chair Hoyer, Supervisor Brusky, Supervisor Linssen, Supervisor Evans and Supervisor De Wane
Also Present: Supervisor Tran, Supervisor Borchardt, Hospital Administrator Luke Schubert, Director of Nursing - NPC & Bay Haven Mandy Woodward, Public Health Officer Anna Destree, Health and Human Services Director Erik Pritzl, Community Services Administrator Jennifer Hoffman, Finance Manager Erik Johnson, Deputy Executive Jeff Flynt, Judge Zuidmulder, TAD Grant Coordinator Mark Vanden Hoogen, Brian Zaletel (Schenk), Lisa Horn (Schenk), Barbara Vanden Boogart, Noel Halvorsen.

I. **Call Meeting to Order.**

The meeting was called to order by Chair Hoyer at 6:01 pm.

II. **Approve/Modify Agenda.**

Motion made by Supervisor Brusky, seconded by Supervisor Linssen to take Item 11 following Item 3 and approve as amended. Vote taken. MOTION CARRIED UNANIMOUSLY

III. **Approve/Modify Minutes of May 30, 2018.**

Motion made by Supervisor De Wane, seconded by Supervisor Brusky to approve. Vote taken. MOTION CARRIED UNANIMOUSLY

Comments from the Public. None.
Report from Human Services Chair. None.

1. **Review Minutes of:**
   a. **Mental Health Treatment Committee (May 16, 2018).**

Motion made by Supervisor Linssen, seconded by Supervisor Brusky to approve. Vote taken. MOTION CARRIED UNANIMOUSLY

b. **Veterans' Recognition Subcommittee (May 15, 2018).**

Motion made by Supervisor De Wane, seconded by Supervisor Evans to approve. Vote taken. MOTION CARRIED UNANIMOUSLY

Presentations by Judge Zuidmulder

2. **Report on Treatment Courts.**

Judge Zuidmulder provided a handout, a copy of which is attached. He informed that Judge Kelley recently decided for personal reasons that he could no longer preside over the Veterans Treatment Court and at that time Judge Zuidmulder decided to take on the Veterans Treatment Court in addition to the Heroin Treatment Court as he believes the Veterans Treatment Court is essential to the community. He now spends from 8:00 am until noon every Friday working with the treatment courts.

Judge Zuidmulder continued that there are evidenced based standards that exist for treatment courts that say what best practices are. As the new judge, he would like the Veterans Treatment Courts to be more reflective of best practices. He has met with the mentors and others involved and they shared their concerns that no veteran should be left behind. Judge Zuidmulder understood this and said that if the veterans feel there should be a separate track for people who would benefit simply by coming in front of a

judge, he would try to find time to create another opportunity for those individuals. He believes that veterans are entitled to that because in their service to the republic, they have been put into circumstances that have changed their life and that it is the community's responsibility to address that in the criminal justice system as appropriately as possible. Judge Zuidmulder is not exactly sure what that separate track may look like, but he wanted to share this with the Committee to make them aware that it is being considered.

Judge Zuidmulder also noted that the Veterans Treatment Court is known as the NE Wisconsin Veterans' Treatment Court because over time there has been an increased call upon the County levy for things the Veterans Court does, but his position is that participants have to be Brown County residents. There are 72 counties in the state and residents of Brown County are blessed because they live in a County that knows the value of treatment courts. With all due respect, Judge Zuidmulder does not think Brown County should be caring for people whose County Boards are penny pinchers and do not want to fund treatment courts. He would be agreeable, however, to take people in to the court if their own county was willing to put forth some scholarship funds that could help offset the costs.

Each participant in the Veterans Treatment Court is assigned a mentor who has experience with similar issues; they have walked the walk. This is unique and Judge Zuidmulder has been asked why other treatment courts do not utilize mentors. He found the problem is that the populations in the other treatment courts have individuals who are involved in criminal thinking and making good matches may be difficult. Judge Zuidmulder encouraged Supervisors to attend treatment court sessions and graduations.

The numbers on the handout were discussed and Judge Zuidmulder specifically pointed out the law enforcement contact numbers outlined on the last two pages which show dramatic reductions in the number of calls to individuals when they are enrolled in the treatment. He said he frequently hears from law enforcement how appreciative they are for the treatment courts because they dramatically reduce nuisance calls.

It was noted by Judge Zuidmulder that funds were set aside in the 2018 budget for a case manager for the OWI Treatment Court, however, that court is taking longer to get started than was originally intended and he is going to insist the funds allocated for the OWI Treatment Court case manager be used for a case manager in the Veterans Treatment Court until the OWI Treatment Court gets going. The case manager does things like follow up with the participants to see that they are attending medical appointments and AODA appointments and this is something the Veterans Treatment Court has not had before. Hopefully this will help get the Veterans Treatment Court better organized and help things run smoothly.

Supervisor Linssen questioned how many of the participants in the Veterans Treatment Court are not Brown County residents. It was indicated that at this time all of the participants in the Veterans Treatment Court are county residents and it was noted that earlier this year Judge Kelley implemented that all Veterans Treatment Court participants be Brown County residents.

Supervisor Brusky asked if the mentors in the Veterans Treatment Court were taking care of the functions the case managers are now performing. Judge Zuidmulder responded that those functions were not taking place as effectively as they should have been in the past. Brusky thanked Judge Zuidmulder for taking on the additional activities for the Veterans Treatment Court.

Chair Hoyer thanked Judge Zuidmulder for his presentation as well as for all of the work he has done for the treatment courts.

Motion made by Supervisor Evans, seconded by Supervisor De Wane to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY

3. Report/Discussion on Pilot Housing Program.

Judge Zuidmulder said he was on the Mental Health Ad Hoc Committee and for many, many meetings he talked about the issue of safe and stable housing for individuals enrolled in the treatment courts. One of the gaps we have is that people are being sent back to housing situations that are not stable and are not healthy because there is no opportunity to put them anywhere else. Judge Zuidmulder said last fall he was told there would be a model program and that money was going to be set aside for it. Part of what he was told is that there was a concern as to whether landlords would really want to be involved. Judge Zuidmulder then made a presentation at the Apartment Owners Association about the treatment courts and he told them that he felt that as part of their good corporate citizenship they should participate in this to the extent that they recognize this is a need in the community. There were 15 – 20 landlords who said that they wanted to be involved in this. The model discussed was that there would be money from the County and then there would be an entity that would get the money and become the lessor. Because these apartments would be under the control of the courts, Judge Zuidmulder advised the landlords they would not have to worry about eviction or anything of that nature because this is a privilege to the treatment courts participants and if they do not live up to the expectations, they would be removed from the housing unit. This is not housing for homelessness; it is temporary housing of 90 days to 6 month that is safe and stable.

Judge Zuidmulder continued that he was told in January that this was going to happen and he then had some meetings with Corporation Counsel and questions were raised about the third party. He then spent some time contacting faith based organizations and the jail ministry came forward and said they would be glad to do this. Now he sees that the Human Services Department has designed some program and there is an RFQ related to that on the agenda tonight. Judge Zuidmulder is out of the loop, does not know what is going on and does not even know if what is being proposed will be able to be used by him for the treatment courts or if the program is even viable and will get off the ground. He is frustrated and unhappy and feels misled. He spent a lot of time on this initiative and does not feel it is fair to call upon him to go out in the community and promote something like this and then be cut out of the loop. He urged the Committee to try to find out what is going on to the extent they can and let the appropriate people know that they should be talking to Judge Zuidmulder about all of this so the program is implemented in a way that will be useful to him and the treatment courts. He does not intend to devote any more of his time to this and reiterated that he is very frustrated and unhappy.

Supervisor Evans wanted to clarify why Judge Zuidmulder is unhappy. Judge Zuidmulder responded that he brought this up months ago and funds were appropriated, but now it is off somewhere and six months later he does not have any idea what is going on and whether it is going to be useful to him or not. He would rather be told that they do not need him promoting this or talking to people about this anymore if that is what he needs to be told, but it is not fair to him to have him involved and out there promoting this and putting his name out there with it and then just freeze him out. Evans appreciated Judge Zuidmulder's perspective and said this certainly plays into the treatment courts. Judge Zuidmulder reiterated he was told that this would be a model for the treatment courts to use and, as such, he feels it would have been good for some conversations to be had with the judges about this and Evans agreed.

Supervisor De Wane understood Judge Zuidmulder's frustration and suggested that staff present at the meeting address this.

Motion made by Supervisor Evans, seconded by Supervisor Linssen to receive and place. Vote taken. MOTION CARRIED UNANIMOUSLY

Motion made by Supervisor Evans, seconded by Supervisor Linssen to suspend the rules to take Item 9a at this time. Vote taken. MOTION CARRIED UNANIMOUSLY

Although shown in the proper format here, Item 9a was taken at this time in conjunction with Item 3.

Communications

4. Communication from Supervisor Dantinne re: To have the County look at where we spend our money for senior programs at ADRC Center. *Referred from June County Board.*

Hoyer informed he has spoken with Supervisor Dantinne regarding this. Dantinne directed the questions he had to the Director of the ADRC, who answered all of them.

Motion made by Supervisor De Wane, seconded by Supervisor Linssen to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY

5. Communication from Supervisor Hoyer re: Re-establish the Homeless Issues and Affordable Housing Sub Committee which reports to Human Services. *Held for 30 days.*

Motion made by Supervisor De Wane, seconded by Supervisor Linssen to take Item 10a together with Item 5. Vote taken. MOTION CARRIED UNANIMOUSLY

Hoyer recalled at the last meeting a motion was made to hold this for 30 days and also to send to staff to come up with possible missions and a name. Pritzl then met with a few people, including Noel Halvorson, and put together a document intended to provide supplemental information to the communication, a copy of which is attached. Pritzl said the handout is based on conversations he was directed to have with leadership of the Housing and Homeless Coalition as well as Noel Halvorson of NeighborWorks and other interested parties. Based on these conversations and current issues that are not being picked up anywhere else, this document was created.

Pritzl continued that the proposed name would be *Safe and Stable Housing Sub-Committee* which fits with a report that was submitted to this Committee in the past. Pritzl outlined the goals on the handout and also noted that the handout contains a list of members they feel would be key players to have around the table.

De Wane said typically a sub-committee is put together by the Committee Chair. Hoyer agreed but said he would rather go into this with the full support of the Human Services Committee. The process of establishing the sub-committee was discussed and whether it was necessary for the standing Committee to approve it or not.

Evans asked if this Safe and Stable Housing Sub-Committee would take a different focus than what is currently being done by the Housing and Homeless Coalition. He said he has seen in other committees where everyone is focused and good hearted, but are in competition with others on the committee for their own organizations and would like to hear from Noel Halvorsen to get his perspective.

Noel Halvorsen, 2443 Deckner Avenue, Green Bay, WI
Halvorsen said he has had a few meetings with Pritzl along with the current chair of the Homeless Coalition and others and the proposal that Pritzl brought forward is spot on in his opinion. It is not duplicating the work of any other body that exists in town and really looks at the policy framework and issues and the barriers that are being inadvertently created that are preventing housing for a vulnerable population. Housing issues like were discussed earlier this evening could be benefited by this Subcommittee. Evans asked how many people Halvorsen felt would be on the subcommittee. Halvorsen responded that he would not recommend more than nine members. He noted that there are housing issues that come up in Planning, housing issues that come up in Health and Human Services and other areas and all those elements could be represented on the Subcommittee as well as some of the practitioners in the field and others in the community that may have the ability to provide value in terms of the objections of the Sub Committee. Halvorsen continued that he understands what Evans said earlier about people being on a committee who care deeply about an issue in the community, but they are also focused on their own piece of the problem and they sometimes have a hard time looking past that to see

more of the problem they are trying to address. The document Pritzl provided with the suggested membership is people who are capable of thinking about the system and services as a whole and what the committee and community is trying to do in serving the population to keep them from getting into even more dire straights. The hallmark of someone you would want on this committee is someone who can see the forest through the trees and work collaboratively with others across organizations or across the communities.

Linssen noted the proposed membership list includes only one County Board Supervisor and asked the Committee for their thoughts as to whether they would like to limit it to one Supervisor or change that to make it more flexible. Hoyer said the membership seems to be more of a function of making motions and voting, but anyone interested could come to meetings to listen or give input. De Wane recommended that it be kept to one Supervisor because there are so many different entities with different expertise and so many ways to look at things and he would rather see more of those people involved. One Supervisor could be a member of the group and then report back to this Committee as to the progress being made.

Motion made by Supervisor De Wane, seconded by Supervisor Evans to support establishment of the Safe and Stable Housing Sub-Committee. Vote taken. MOTION CARRIED UNANIMOUSLY

Wind Turbine Update

6. Receive new information – Standing Item.

Barbara Vanden Boogart, President of BCCRWE, addressed the Committee and provided a handout, a copy of which is attached and is also available in the County Board Office. She spoke to this handout as follows:

COMMENT'S BY {BCCRWE PRESIDENT} BARBARA VANDEN BOOGART BEFORE THE BROWN COUNTY, WI. HUMAN SERVICES COMMITTEE ON JUNE 26, 2018 REGARDING KEITH STELLING'S ARTICLE CONCERNING THE DECADE LONG NASA STUDY LED BY NEIL KELLEY AND MORE CONTEMPORARY STUDIES THAT VALIDATE THE NASA STUDY FINDINGS.

I assume that many if not most of us in this room are familiar with the classic movie "The Matrix". In the movie, one of the two main characters whose name was Morpheous, offered the other main character Neo, a blue pill contained in one hand and a red pill contained in the other. If you take the blue pill you can perhaps live on in blissful ignorance. If you take the red pill, you live a life of consciously seeking and accepting truth, even if it's uncomfortable or conflicts with previously held and cherished beliefs and bias'. Once the truth is known to you by taking the red pill, you then take the appropriate measures to address that truth, no matter how uncomfortable. In this particular case regarding Industrial Wind Energy, I offer you the red pill contained within the red folder that will be provided to you. The ingredients in this particular red pill contain the raw truth about the decade long NASA study concerning Industrial Wind and the Industry's knowledge of the problem as well as how some more recent and current studies that further validate Neil Kelley's findings during the NASA study.

Once you hear the excerpts and read this document, you have then taken one of the red pills concerning Industrial Wind, (and it's a foundational one at that). You cannot undo the truth and facts of what you know, nor the associated responsibility to appropriately act upon it. From this evening on, if anyone chooses to allege that there are only anecdotal reports, that correct studies have not been conducted or that this is merely the noceebo affect, then they have chosen to be willingly ignorant or are feigning ignorance, for reasons of political bias, political benefit, ambition or allegiance, or because of financial conflict, job security considerations, budget considerations, or callus hardheartedness regarding the suffering of Brown county residents. Or…a rigid adherence to policy, which is characterized in this case by obvious regulatory capture, over and above the duty to protect and relieve the suffering of their fellow human beings (in this case ones within our own county.)

Everyone in this room who will now know the truth, that then at some future date hears those allegations will know that they have chosen to do so based on the previously listed reasons and any respect for their intellectual and moral integrity will then be questioned in the minds of those hearing them. Even though I will submit this document to you, I ask for your patient attentiveness now as I read excerpts and add an occasional interjection. Believe it or not this is only a small portion of the document. The document that I'm about to read from was published several years ago and several other important studies since that time have been conducted that scientifically further confirm and validate the NASA study. This may take a bit of time, however the suffering people in Shirley Wind are worth it … aren't they? Our hope as an organization representing hundreds of Brown County Citizens is that each of you tonight will have the intellectual and moral integrity to willingly take the red pill, as we did over eight years ago, and that you will act responsibly with that knowledge in mind. That you will take this red pill home and digest it by reading it in it's entirety, since while it isn't exhaustive, it is foundational to understanding this issue. We have confidence that many of you will.

Vanden Boogart also read a number of excerpts from the study to the Committee and commented on them.

Following Vanden Boogart's comments, Hoyer indicated he would like to revisit whether this agenda item is doing what it was intended to do. He said with all due respect, the Committee knows about the NASA study and has seen hours of Rick James and while maybe it was brought together in a new way, that is not the intention of the County Board Office being the storehouse for this information. He said this is an excellent, very thoughtful secondary accumulation of things, but asked the Committee for their input. Linssen responded that the purpose of this agenda item is to receive new studies, not be lectured to and he would like to see this reflected in future agendas. De Wane agreed and said that all that is being presented is the same stuff we have been getting and said comments should be limited to five minutes. Hoyer suggested that in the future this be handled under *comments from the public* and be limited to five minutes. Vanden Boogart noted that she has referred to this study before, but it has never been submitted and she feels it would do the Committee well to have it since it is so foundational. Hoyer said the study has been around since the 1970s and the Committee is all aware of it. Vanden Boogart responded that there is no evidence the Committee has ever read it. Linssen said his suggestion would be to limit this to new information of academic studies only or something similar as this was never intended to be a second public comment section.

Evans said this has been on the agenda for a number of years and there seems to be interest by the public to come. He considered this new information and noted that people are passionate on both sides of this issue and he does not like to limit public comments to five minutes. He feels it is appropriate for the public to be able to come and speak as long as they stay on topic. He would personally like to see this item remain on the agenda as it currently is.

Motion made by Supervisor Evans, seconded by Supervisor De Wane to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY

Health & Human Services Department

7. Budget Adjustment Request (18-70): Reallocation of more than 10% of the funds original appropriated between any of the levels of appropriation.

This budget adjustment is to reclassify the amount not needed for Software Maintenance expense to Outlay Equipment account to allow for transfer of used vehicle from Port to Human Services. This vehicle is needed to replace an older vehicle which is close to the end of its useful life.

Motion made by Supervisor De Wane, seconded by Supervisor Evans to approve. Vote taken. MOTION CARRIED UNANIMOUSLY

8. Budget Adjustment Request (18-77): Any increase in expenses with an offsetting increase in revenue.

This budget adjustment is for estimated 2018 donation activity to the Community Services division of Health & Human Services. Donations revenue will directly offset purchases made with donated funds.

Motion made by Supervisor Brusky, seconded by Supervisor Linssen to approve. Vote taken. MOTION CARRIED UNANIMOUSLY

9. Executive Director's Report.

Motion made by Supervisor De Wane, seconded by Supervisor Evans to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY

a) Safe and Stable Housing Pilot RFQ (Draft).

Although shown in the proper format here, this Item was taken in conjunction with Item 3 above.

Pritzl said the RFQ before the Committee is doing what the judge alluded to earlier; finding an intermediary to find units that we would provide funding for, they would monitor the units, assure quality of the units and we would move people in and out of the units. Nothing has changed from the initial description either from fall or in any conversations had between January and March. Pritzl continued that there have been conversations that occurred between Judge Zuidmulder and Corporation Counsel and then Corporation Counsel followed up with Pritzl asking some questions and seeking input as to how to make this work because we are taking on the funding of housing which has its own unique features in terms of who is acquiring the unit, who is providing the funding for the unit, who is on the lease and how to move people in an out for non-compliance. They tried to work to create something administratively that will work and something they will get parties to bid on that they can get units with.

Hoyer asked if this is a matter of putting this as an RFQ to follow the process rather than contacting individuals. Pritzl said it was. He continued that if you go and pick someone, there are definitely landlords in the community that will come forward that will ask why they did not have the opportunity to do this or say they can provide similar units for a different price. There are also a number of agencies in the community that provide housing services and we need to be sure that there is some process for interested parties to express their interest. Pritzl continued that an RFP will take longer and what we are really looking at here is a price constraint product and that is why they did the RFQ.

Evans said Pritzl said that Judge Zuidmulder had meetings with Corporation Counsel on this and then Corporation Counsel contacted Pritzl. Pritzl said that is loosely correct, however, Judge Zuidmulder interjected that that is incorrect. Judge Zuidmulder said Corporation Counsel advised him that he did not feel Brown County should be buying units. He informed Corporation Counsel that he never once suggested this should be anything other than rentals and explained his idea to Corporation Counsel who then said that that was something they could do. In the next conversation Judge Zuidmulder had with Corporation Counsel, Corporation Counsel said they were thinking about something else and Judge Zuidmulder asked if he could go out and talk to entities in the community that are already involved in this area to see if they were interested in taking this on. Corporation Counsel advised Judge Zuidmulder that that would be fine. The next time Judge Zuidmulder talked to Corporation Counsel he was advised that they were going in a different direction and then this RFQ came about.

Judge Zuidmulder questioned what good it would be to get someone to respond to the RFQ that could say they have six units to rent out in Pulaski? Judge Zuidmulder said the units should be spread out throughout the community and have to be on the bus line. The RFQ looks like it is creating something that will then be handed to him but would be totally useless. He has asked and pled for certain things, but now it looks like they have gone in a totally different direction. If that is the case, this cannot be claimed to be something designed for the treatment courts because if there is no connection between the vendor and the person who is going to get the service, it cannot work. Evans said it sounds like Judge Zuidmulder feels like if this is passed he will be handcuffed into having something that he did not have input on and may potentially not work. Judge Zuidmulder responded that it would be a waste of the County's money because it is not designed to meet the need.

Pritzl commented that this is the first time he has heard that units should be spread throughout the community and be on a bus line. Evans said the problem is that there have not been any conversations to talk about the specifics. Pritzl said perhaps those specifics were not discussed at conversations that did occur. Evans said he cannot support this until there are some deeper conversations, and all the nuances are ironed out.

Linssen recalled this was on the agenda several months ago and the direction was for Pritzl to come forward with some sort of plan which is what he did. Pritzl said given what he has heard tonight, the RFQ will not go out in draft form. He can bring back a revised draft to include Judge Zuidmulder's vendor qualifications so we can have a better vendor selection. If what is being looked for is to pursue an option where specific vendors are identified and selected, he does not know how that fits with other procurement practices. Pritzl feels this is about vendor qualifications. He can get some language from the Judge that will steer the right vendors into this and then bring it back next month. Hoyer said that although Judge Zuidmulder has done the lion's share of the work on this, he feels this maybe should be extended to other judges in the treatment courts for input.

Judge Zuidmulder said the big problem is what happens if a vendor finds apartments, but the apartments are not suitable for use by the treatment courts. Linssen noted that Pritzl has certain requirements he has to go through as far as procurement. Judge Zuidmulder understood that, but said the vendors must be told that if they bid on the contract, they will have to work with the treatment courts with regard to securing the places that are satisfactory to the requirements of treatment courts. There is no connection between the proposal being presented and the providing of units that meet the needs of the treatment courts. Judge Zuidmulder continued that there is no ability to also tell the vendor after the fact that their unit will not work so if a vendor says they have apartments but then are not told they cannot be used because they do not meet the needs of the treatment courts, they will say they are still entitled to the $65,000 because that is all the County contracted for.

De Wane understood where the Judge is coming from. He said the contracts must state the apartments need to meet the requirements that are satisfactory to the treatment courts. Linssen asked if Pritzl would have any problem altering the RFQ to meet the needs Judge Zuidmulder set forth. Pritzl said this can be written in a way that the vendors have to meet certain qualifications. Judge Zuidmulder said it is frustrating to him to have to come here to get this done. Pritzl said this conversation could have been had prior to this meeting but Judge Zuidmulder noted that he is a volunteer when it comes to the treatment courts and he should not have to go hand in hand begging for things that need to be done for the betterment of the community. Pritzl said what he is asking for is specific vendor qualifications so it can be worked into an RFQ that can go out so we can get this accomplished.

Motion made by Supervisor Evans to send back to staff. ***No second, no vote taken.***

Motion amended by Supervisor Linssen, seconded by Supervisor Evans to send back to staff with direction to consult with court staff of the various treatment courts and to add language to the RFQ to ensure it meets the needs of the treatment courts. Vote taken. MOTION CARRIED UNANIMOUSLY

Motion made by Supervisor Evans, seconded by Supervisor De Wane to approve motion as amended. Vote taken. MOTION CARRIED UNANIMOUSLY

10. Communications Update.

a) Re-establish the Homeless Issues and Affordable Housing Sub Committee which reports to Human Services.

See discussion and action at Item 5 above.

11. Presentation of CTC Internal Operational Analysis Overview by Schenk.

Brian Zaletel, Senior Practice Consultant at Schenck introduced himself and Senior Manager Lisa Horn to the Committee. Zaletel said he is a CPA as well as a licensed nursing home administrator and they have worked with the CTC to figure out some opportunities for sustainability that would make a positive impact on the tax levy. A Power Point was presented, a copy of which is attached.

Motion made by Supervisor Brusky, seconded by Supervisor De Wane to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY

12. Financial Report for Community Treatment Center and Community Services.

Finance Manager Erik Johnson informed that when May was closed it was discovered that there were some accounting issues that caused the April figures to look more favorable than they were for Community Services. This shows as a significant overage in costs for services through the end of May, primarily in the area of purchased services. They are in the process of analyzing that and will report more on this at the next meeting. CTC looks to be on track to continue a slightly favorable position compared to budget for the year.

Motion made by Supervisor De Wane, seconded by Supervisor Linssen to receive and place on file. Vote taken. MOTION CARRIED UNANIMOUSLY

13. Statistical Reports.
a) Monthly CTC Data.
i. Bay Haven Crisis Diversion.
ii. Nicolet Psychiatric Center.
iii. CTC Double Shifts.
b) Child Protection – Child Abuse/Neglect Report.
c) Monthly Contract Update.

Motion made by Supervisor De Wane, seconded by Supervisor Linssen to suspend the rules to take Items 13a, 13a(i), 13a(ii), 13a(iii), 13b & 13c together. Vote taken. MOTION CARRIED UNANIMOUSLY

Motion made by Supervisor De Wane, seconded by Supervisor Brusky to receive and place on file Items 13a, 13a(i), 13a(ii), 13a(iii), 13b & 13c together. Vote taken. MOTION CARRIED UNANIMOUSLY

14. Request for New Non-Continuous and Contract Providers and New Provider Contract.

Motion made by Supervisor Evans, seconded by Supervisor De Wane to approve. Vote taken. MOTION CARRIED UNANIMOUSLY

Aging & Disability Resource Center - No items.
Syble Hopp – No items.
Veterans Services – No items.

Other
15. Audit of bills.

Motion made by Supervisor Linssen, seconded by Supervisor Evans to acknowledge receipt of the bills. Vote taken. MOTION CARRIED UNANIMOUSLY

16. Such other Matters as Authorized by Law.

The joint meeting between the Human Services Committee and Public Safety Committee was discussed. This meeting is scheduled for July 12, 2018 at 4:00 pm, but it was noted that several Supervisors have a conflict with that date and time.

Brusky informed she will not be able to attend the regularly scheduled Human Services Committee meeting on July 25 so this meeting was tentatively rescheduled to July 23, 2018 at 6:00 pm.

17. Adjourn.

Motion made by Supervisor De Wane, seconded by Supervisor Evans to adjourn at 8:36 pm. Vote taken. MOTION CARRIED UNANIMOUSLY

Respectfully submitted,

Therese Giannunzio
Administrative Specialist

BROWN COUNTY HEALTH & HUMAN SERVICES
Treatment Alternatives and Diversion Program
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Drug Court:
Judge Marc Hammer

Category	Number
Total Participants to Date	128
Current Participants	22
Additional Approved Participants (awaiting start date)	0
Individuals in Referral Process	7
Successful Graduates	37
Terminations within the first 60 days of acceptance	6
Total Number of Terminations	51
Graduations in the last reporting period	3

The Brown County Drug Court held its first court session on 7/31/09.The target population of Drug Court are individuals that have had heavy involvement with the criminal justice system (Prior Prison Sentences, Failed Probationary periods or Treatment, Significant Criminal Charges) that have an identified AODA need. The national average for terminations is between 25-40%; with 118 total participants and 49 terminations we are currently at 41%. If you exclude terminations that occurred within the first 60 days of acceptance our termination rate is at 37%.

NEW Veterans Treatment Court:
Judge Donald Zuidmulder

Category	Number
Total Participants to Date	83
Current Participants	19
Additional Approved Participants (awaiting start date)	2
Individuals in Referral Process	4
Successful Graduates	48
Terminations within the first 60 days of acceptance	6
Terminations related to absconding (including those within 60 days acceptance)	4
Total Number of Terminations	14
Graduations in last reporting period	4

The NEWVTC accepted its first participant on 3/20/2012. The NEWVTC Treatment Court is designed specifically to staff and handle cases involving offenders with veteran status through an intensive, judicially monitored program of alcohol, drug, and mental health treatment, rehabilitation services and strict community supervision.

Mental Health Court:
Judge Donald Zuidmulder

Category	Number
Total Participants to Date	50
Current Participants	17
Additional Approved Participants (awaiting start date)	2
Individuals in Referral Process	2
Successful Graduates	11
Terminations within the first 60 days of acceptance	7
Total Number of Terminations	18
Graduations in last reporting period	1

The Mental Health Court accepted its first participant on 03/20/2015. The Mental Health Court serves individuals within the community who have a diagnosed serious/persistent mental health need. Additionally, that unmet need is evidenced to be the primary factor behind their ongoing criminal justice involvement. The Mental Health Court's goals are to re-establish participants with their providers, develop an obtainable independent living plan, and provide intensive case management and supervision services.

Heroin Court:
Judge Thomas Walsh

Category	Number
Total Participants to Date	59
Current Participants	20
Additional Approved Participants (awaiting start date)	0
Individuals in Referral Process	5
Successful Graduates	23
Terminations within the first 60 days of acceptance	6
Total Number of Terminations	21
Graduations in last reporting period	4

Heroin Court accepted its first participant on 03/26/15 and held its first court date on 4/2/16. The purpose of the court is to specifically address the growing abuse of Heroin and Opiates in Brown County and to provide comprehensive treatment and supervision services to individuals within Brown County. In addition to serving the High Risk/Need population that exhausted conventional means of supervision and treatment, the Heroin Court also admits individuals with first time heroin/opiate crimes in order to preemptively provide the needed services to reduce risk of serious harm.

OWI Court
Judge John Zakowski

Category	Number
Total Participants to Date	0
Current Participants	0
Additional Approved Participants (awaiting start date)	0
Individuals in Referral Process	5
Successful Graduates	0
Terminations within the first 60 days of acceptance	0
Total Number of Terminations	0

The OWI Court target population will be individuals that have an OWI 4th with a B.A.C of .15 and above.

Brown County Diversion Program (Numbers are from 10/2016)

Category	Number
Total Participants to Date	166
Current Participants	52
Successful Graduates/Completed	91
Total Number of Terminations	31

The purpose of the Brown County Diversion program is to divert low risk or first time offenders away from the criminal justice system. This is done by addressing the "root" of the problem that led to the criminal activity. All referrals come for the District Attorney's office for consideration.

Brown County Treatment Court Statistics

Heroin Court

Police Calls/Contacts (Prior Heroin Court)	Jail Placements (Prior Heroin Court)	Police Calls/Contacts (Post Heroin Court)	Jail Placements (Post Heroin Court)
1157	435	73	43

There was a 94% decrease in Police Calls/Contacts during and after completion of Heroin Treatment Court and 90% decrease in Jail Placements from pre to post treatment court.

Veterans Treatment Court

Police Calls/Contacts (Prior VTC)	Jail Placements (Prior VTC)	Police Calls/Contacts (Post VTC)	Jail Placements (Post VTC)
353	248	118	25

Updated 06/26/18

There was a 67% decrease in Police Calls/Contacts during and after completion of VTC and a 90% decrease in Jail Placement from pre to post treatment court.

Mental Health Court

Police Calls/Contacts (Prior MHC)	Jail Placements (Prior MHC)	Police Calls/Contacts (Post MHC)	Jail Placements (Post MHC)
1469	494	93	52

There was a 94% decrease in Police Calls/Contact during and after completion of MHC. There was a decrease of 90% of jail placements during and after MHC.

Drug Court

Police Calls/Contacts (Prior Drug Court)	Jail Placements (Prior Drug Court)	Police Calls/Contacts (Post Drug Court)	Jail Placements (Post Drug Court)
1139	525	80	57

There was a 93% decrease in Police Calls/Contact during and after completion of Drug Court. There was a decrease of 89% of jail placements during and after Drug Court.

Total of All Brown County Treatment Courts

Police Calls/Contacts (Prior Treatment Court)	Jail Placements (Prior Treatment Court)	Police Calls/Contacts (Post Treatment Court)	Jail Placements (Post Treatment Court)
4118	1702	364	177

Overall when you factor in all of the Treatment Courts there is a 91% decrease in Police Calls/Contacts and a decrease of 90 % in Jail Placements post involvement with Treatment Courts.

Re: # 10a

BROWN COUNTY HEALTH & HUMAN SERVICES

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P.O. Box 22188
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Erik Pritzl, Executive Director

Phone (920) 448-6000 Fax (920) 448-6166

To: Brown County Human Services Committee

From: Erik Pritzl, Executive Director

Date: June 27, 2018

Re: Homeless Issues and Affordable Housing Sub-Committee

This document is intended to provide supplemental information to the communication previously made by Supervisor Hoyer on April 17, 2018 regarding the re-establishment of the Homeless Issues and Affordable Housing Sub Committee. Previously, this sub-committee reported to the Human Services Committee and as such, the following information is presented to this committee for review and consideration.

The information presented here was compiled after meetings with Noel Halvorsen, President and CEO of Neighborworks, Karen Michaels, Executive Director of Golden House and governing board chair of the Brown County Housing and Homeless Coalition, and other interested parties.

Proposed Name:

Safe and Stable Housing Sub-Committee

Goals:

Identify policy issues and opportunities/improvements to better support safe and stable housing options for vulnerable populations.

Identify community assets that can support housing efforts and identify barriers easily removed to improve to safe and stable housing options for vulnerable populations.

Enhance community capacity through best practice research, awareness and implementation support to maximize efficiency of current resources.

5 & 10a

Membership:

In general, members should have an expressed interest in housing and homeless issues, have the ability to use system's level thinking to analyze complex issues that span departments and populations, and have an interest in data-driven and best practice solutions.

To optimize efficiency and function, sub-committee membership size should be limited to no more than nine members.

Considering the committee's goals, the recommended membership and support should include people representing the following:

- Local Planning, Zoning and Land Services
- Health and Human Services
- BCHHC Leadership
- County Board Supervisor(s)
- Housing Authority
- A person with research experience or affiliation with a higher education institution.
- Up to 3 members that provide direct service or develop housing resources for vulnerable populations.

5+10c

Brown County Community Treatment Center

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Schenck

Objectives

- Short Term Assessment Areas
  - Considerations
    - Operational improvements
    - Revenue enhancement
    - Expense reduction
- Long Term Assessment Areas
  - Considerations
    - Operational improvements
    - Revenue enhancement
    - Expense reduction
    - Ownership options

WORKFORCE CRISIS

Schenck

Workforce Crisis Impact

- 2018 Workforce Crisis Report
  - Drafted by LeadingAge WI, WHCA, WALA, and Residential Services Association of WI – 756 provider responses
  - Average caregiver vacancy rates of 19% with 30% providers experiencing rates 25% and higher
  - Estimated 16,500 vacant caregiver positions in Wisconsin long-term and residential facilities
  - Nearly 54% had no applicants for vacant care positions
  - 83% said there were no qualified applicants for caregiver openings
- LeadingAge WI Workforce Update – 6/22/18
  - Number of CNAs listed on nurse aide registry declined for 6th straight year
  - Since December 2012, there are 9,698 fewer CNAs or a 14% decline in 6 years

Workforce Crisis Impact

- Short Term and Long Term Recommendations
  - Must be sensitive to ability to effectively staff
    - CTC currently has approximately 18 nursing vacancies
      - 10 additional temporary vacancies due to FMLAs
  - In next 30 years, the ratio of WI residents age 65 and older to the entire state population will grow from 1 in 7 to 1 in 4

SHORT TERM ASSESSMENT AREAS

Schenck

Operational Improvements

- Emergency Protective Placement Processes
  - Ensure policies, procedures, and tools such as flow charts are consistent with state regulations and best practices.
  - Provide training through state and local resources that support compliance and best practices.

Revenue Enhancement

- Nicolet Psychiatric Center
  - Medicaid Reimbursement
    - Psychiatric hospitals are reimbursed at rates per diem based on Medicare cost report
      - Reported costs and reimbursement rates have been increasing each year for past two years
      - Gap between other state psychiatric hospitals has been decreasing or eliminated
      - Opportunity to adjust costs allocated to NPC?

Revenue Enhancement

- Bayshore Village
  - Medicaid Reimbursement
    - Direct care component of reimbursement rate is most important driver
      - Resident case mix index is most important driver
        - » Currently no formal, billable restorative program
          - Implementation with only 50% participation could increase reimbursement rate by $1.781ppd

Revenue Enhancement

- Bay Haven
  - Current billing method
    - Change method to allow for retro coverage?

Expense Reduction

- Bayshore Village
  - Options to outsource common areas of Support Services
  - Nursing
    - Nurse/nurse aide staffing model and scheduling approach
      - Overtime reduction
      - Agency reduction
    - Elimination of paid lunches
    - Open positions
      - County process requirements
        - » Impact on overtime and agency utilization

LONG TERM ASSESSMENT AREAS

Schenck

Operational Improvements

- Bay Haven
  - Service line change/addition
    - Detox program managed by contracted service?

Revenue Enhancement

- Bayshore Village
  - Service line addition
    - Memory Care
      - Convert one or two SNF household(s)
        - » Could be SNF and/or CBRF depending on regulatory requirements
      - Improve payer mix
      - Reduce SNF staffing requirements

Expense Reduction

- Trempealeau County Services
  - Brown County 2017 annual spend
    - Approximately $1.6 million in 2017 for 10-12 clients
    - Fiscal impact of returning BC residents to SNF or CBRF?
  - Residents transferred to TC
    - New clients not well known to CTC
    - CTC clients who have had multiple unsuccessful approaches
  - Replicate components of TC continuum of care?
  - Staffing model?
    - Professional, nursing staff, support staff
  - Waivers needed?

Ownership Options

- Are there ownership options being utilized that would allow County to retain some oversight of services provided but allows for costs of services to be shifted to another organization?

THANK YOU!

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Schenck

Infrasound

Low frequency noise
and
Industrial Wind Turbines

An information report prepared for the

MULTI-MUNICIPAL WIND TURBINE WORKING GROUP

MARK DAVIS, DEPUTY MAYOR, ARRAN-ELDERSLIE, CHAIR / STEWART HALLIDAY, DEPUTY MAYOR, GREY HIGHLANDS, CO-CHAIR

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July, 2015

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Introduction

The Multi-municipal Wind Turbine Working Group was formed by municipal councillors in Grey, Bruce, and Huron Counties in Ontario in response to the growing number of complaints they were receiving from constituents concerning the installation of industrial wind turbines throughout the area. Councillors were aware of their responsibility regarding the health, safety, and well-being of their constituents. The Multi-municipal Wind Turbine Working Group was set up to share ideas on how to fulfill that responsibility. Complaints from citizens, including reports of adverse health impacts have persisted and increased as more turbines have been installed. The reported symptoms conform to those described internationally by many people living near wind turbines.

With the proliferation of recent research and the rediscovery of earlier, until now largely ignored studies, infrasound and low frequency noise (LFN) can no longer be dismissed as irrelevant. This report shows why it must be given full consideration as a contributing cause of the distress of some of those people living near wind turbine installations. It also demonstrates why the Ontario and Canadian governments must pay attention to this research, fulfill their obligation to protect the health of our citizens and amend their wind turbine regulations and policies.

Executive summary

Typically, regulating authorities have not required the measurement of infrasound (sound below 20 Hz in frequency) and low frequency (LFN) (generally sound from 200

Hz to 20 Hz) inside homes adjacent to wind turbines as a condition of their installation and operational monitoring.[1] The health risk of infrasound from wind turbines has been dismissed by the wind industry as insignificant. It has maintained that since the typical loudness and frequency of wind turbine sound within a home is not audible, it cannot have any effect on human health.

Noise measurements for most studies and environmental assessments have been limited to the measurement of *audible* sound *outside* homes-- using dBA weighted monitoring which is insensitive to infrasound frequencies. Some studies and environmental assessments have even relied on *projected* audible sound averages from computer produced models.

Such observations and projections fail to take appropriate account of the distinguishing signature of the sound from a wind turbine. Unlike the more random naturally occurring sounds (such as wind or lake waves which may themselves have an infrasound component), the sound from wind turbines displays characteristics that produce a *pattern* that the ear and audio processing in the brain recognize. Our hearing is strongly influenced by pattern recognition. (This is why we can pick out the sound of a familiar voice even in a crowded room with many people speaking).

One recognizable wind turbine pattern is a tonal signal of *sharply rising and falling pulses* in the infrasound range, (typically about 0.75 Hz, 1.5 Hz, 2.25 Hz, 3.0 Hz, and so on). It is produced by the blade passing the tower. At this frequency these pulses may be "felt or sensed" more than "heard" by the ears. Research by Dr. Alec Salt and others has demonstrated that subaudible infrasound does result in a physiological response from various systems within the body.

[1] Denmark does require a calculation of the *expected* infrasound; however it is less restrictive than limits on *audible* sound.

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The second recognizable pattern is the amplitude modulation. This is the typical "swoosh" rising and falling that *is* audible. [2]

A third recognizable pattern of sound from wind turbines results from the equipment in the nacelle (such as the gearbox if the turbine has one) and ventilating fans. Although in some cases this third sound source may become predominant, it is usually of lesser effect that the first two.

We now know that *subaudible pulsating infrasound can be detected inside homes* near operating wind turbines. It can also be identified up to 10 kilometres distant. We know also that *very low levels of infrasound and LFN are registered by the nervous system and affect the body even though they cannot be heard.* The research cited in this report implicates these infrasonic pulsations as the cause of some of the most commonly reported "sensations" experienced by many people living close to wind turbines including chronic sleep disturbance, dizziness, tinnitus, heart palpitations, vibrations and pressure sensations in the head and chest etc.

Similarly, there is medical research (also cited below) which demonstrates that pulsating infrasound can be a direct cause of sleep disturbance. In clinical medicine, chronic sleep interruption and deprivation is acknowledged as a trigger of serious health problems.

[2] It results from the blade passage frequency which acts to cause the broadband sound produced by the turbulence associated with the airfoil of the wind turbine passing through the air to rise and fall.

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I. The work of Neil Kelley

1979: First report of human distress from wind turbines

The first wind turbine noise complaints in North America, reported over 35 years ago, sound strikingly familiar today. Residents living within 3 kilometres of a 2 MW wind turbine near Boone, North Carolina, described a periodic "thumping" sound accompanied by vibrations. Many said that they could "feel" more than hear the sounds. They spoke of repetitive sleep disturbance and maintained that the sounds were louder and more annoying inside their homes than outside; some became more sensitive to the impact over time.

The overlooked documents on wind turbine infrasound

In response to the complaints from Boone, the U.S. Department of Energy and the National Aeronautics and Space Administration (NASA) commissioned Dr. Neil Kelley and his colleagues at the Solar Research Institute (which later became the National Renewable Energy Laboratories of the US Department of Energy) to investigate possible causes. Over the next ten years, Kelley was able to take advantage of government and NASA facilities and funding to carry out extensive field investigations and laboratory research of a scope and thoroughness that has not been matched since. He also had access to experts at six leading American Universities as well as the co-operation and input of the wind turbine industry.[3]

[3] In cooperation with NASA, the General Electric Company, and BREMC, Kelley and his associates at the Solar Energy Research Institute (SERI) performed a series of field measurements near the MOD-1 [turbine] during five separate sessions between 1979 and 1981. They were supported by the Pacific Northwest Laboratories and the University of Virginia, Department of Environmental Science. In addition to the measurement programs, SERI conducted ancillary experimental studies at the NASA Plumbrook Facility; the DOE Rocky Flats Wind Energy Research Center; the anechoic wind tunnel of MIT's Department of Aeronautics and Astronautics; and the subsonic wind tunnel facilities of the Department of Aerospace Engineering of the University of Colorado-Boulder (UCB). Analytical and field studies of low-frequency noise propagation in the vicinity of the turbine were conducted by a

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Between 1982 and 1988, Kelley and his colleagues published five important papers:

1. N. D. Kelley, R. R. Hemphill, M. E. McKenna. **"A Methodology for Assessment of Wind Turbine Noise Generation", 1982.** (First published in J. *Solar Engineering,* Vol. 21 (1981), pp.341-356).

2. E. W. Jacobs, N. D. Kelley, H. E. McKenna, N. J. Birkenheuer. **"Wake Characteristics of the MOD-2 Wind Turbine at Medicine Bow, Wyoming". November 1984.**

3. N. D. Kelley, H. E. McKenna, R. R. Hemphill, C. l. Etter, R. l. Garrelts, N. C. Linn. **"Acoustic Noise Associated with the MOD-1 Wind Turbine: Its Source, Impact, and Control". February 1985.** (First published by the Solar Energy Research Institute, February 1985). **(262 pages)**

4. N.D. Kelley. **"A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions", November 1987.**

5. N. D. Kelley, H. E. McKenna, E. W. Jacobs, R. R. Hemphill, J. Birkenheuer. **"The MOD-2 Wind Turbine: Aeroacoustical Noise Sources, Emissions, and Potential Impact".** Solar Energy Research Institute. Prepared for the U.S. Department of Energy, **January 1988.**

His work was published in peer reviewed journals. He presented his paper "Acoustic Noise Associated with the MOD-1 Wind Turbine: Its Source, Impact, and Control" at the Fourth ASME (American Society of Mechanical Engineers) Wind Energy Symposium held in Dallas, Texas on 18-20 February 1985. In 1987 he presented his paper "A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions", at the American Wind Energy Association "Windpower '87 Conference and Exposition", October 5-8, 1987 in San Francisco, California.

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multidisciplinary group at Penn State; and analytical studies of aerodynamic noise generation were performed by the Fluid Dynamics Research Laboratory of MIT's Department of Aeronautics and Astronautics. In addition a number of other organizations were active in the noise investigations: NASA Lewis Research Center--analytical modeling of noise generation by wind turbines; NASA Langley Research Center- aeroacoustical and psychophysical studies of wind turbine noise; General Electric Company Corporate Research Center--analytical and statistical studies of the MOD-I noise situation and wind turbine noise in general; Boeing Vertol Division--wind turbine aeroacoustic studies; Hamilton-Standard Corporation--analytical studies of wind turbine aeroacoustics; the Fluid Dynamics Research Laboratory of MIT's Department of Aeronautics and Astronautics and the Departments of Meteorology and Mechanical Engineering; and the Noise Control Laboratory at Penn State were retained under SERI subcontracts to develop analytical techniques for evaluating the physics of the sound generation process and the propagation aspects of the problem, respectively.

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The NASA investigation by Dr. Neil Kelley and his colleagues *established a link between wind turbine generated impulsive infrasound and low frequency noise and the symptoms (including sleep disturbance)* reported by the Boone, North Carolina residents.

The first report was based on three years of detailed field research. It recorded the experiences of actual people living near turbines through their resident diaries. It involved a complete set of full spectrum acoustic measurements (not estimated computer projections limited to A-weighted sound) extended over the entire 3 year study period. It included sound and vibration measurements as well as detailed meteorological observations.

It was followed by the publication of the results of subsequent laboratory research. Human volunteers were directly exposed in the laboratory to some of the sound energy in the infrasound and low frequency noise frequencies similar to the wind turbine measurements. The individual human responses confirmed an association between infrasound/LFN and the distress experienced by the volunteers.

Kelley's key findings

(1) Wind turbines emit infrasound.

- "The modern wind turbine radiates its peak sound power (energy) in the very low frequency[4] (VLF) range, typically between 1 and 10 Hz."[5]

[4] The audible spectrum of sound for adults is generally considered to range from 20 Hz to 20,000 Hz. Frequencies below 20 Hz are described as *infrasound.* The range from 20 Hz to 200 Hz is usually described as low frequency sound.

[5] N.D. Kelley. "A Proposed Metric for Assessing the Potential of Community Annoyance from Wind Turbine Low-Frequency Noise Emissions", November 1987, p.1.

(2) Wind turbine infrasound and low frequency noise is often subaudible.

- "The detailed analysis of a series of acoustic measurements taken near several large wind turbines (100 kW and above) has identified the maximum acoustic energy as being concentrated in the low-frequency audible and subaudible ranges, usually less than 100 Hz".[6]

(3) Wind turbine infrasound and LFN is characteristically impulsive (pulsating, containing spikes or peaks and valleys).

- "Impulsive noise, such as has been found with the MOD-1, is identified with short, transient fluctuations in the radiated acoustic field which can contain considerable energy".[7]

(4) Community annoyance described by residents

- "Residents living in affected houses reported periodic "thumping" sounds accompanied by vibrations".
- Many said that they could "feel" more than hear the sounds.
- They spoke of repetitive sleep disturbance.
- "These field measurements and model results allowed us to conclude the following: The annoyance was real and not imagined". [8]

(5) Community annoyance is related to impulsiveness

- "These measurements have also shown any reported community annoyance associated with turbine operations has often been related to the degree of coherent impulsiveness present and the subsequent harmonic coupling of acoustic energy to residential structures".[9]

---

[6] N. D. Kelley, R. R. Hemphill, M. E. McKenna. "A Methodology for Assessment of Wind Turbine Noise Generation", 1982, p.1.
[7] *Ibid.*, p.113.
[8] Kelley *et al.* 1985 p. iii.
[9] Kelley *et al.*, 1982, *op. cit.* p.112.

(6) Wind turbine disturbance is detected more *inside* houses than outside.

- "Residents reported the sounds were louder and more annoying inside their homes than outside".
- "Experience with wind turbines has shown that it is possible, under the right circumstances, for low-frequency (LF) acoustic noise radiated from the turbine rotor to interact with residential structures of nearby communities and annoy the occupants". [10]

- "An extensive investigation . . . revealed that this annoyance was the result of a coupling of the turbine's impulsive LF acoustic energy into the structures of some of the surrounding homes. This often created an annoyance environment that was frequently confined to within the home itself".[11]

- "The strong resonant behavior of the indoor pressure field when excited by an external impulsive excitation, all point to a complex resonance condition between the volume of air in the rooms and the vibration (displacement) of the walls and floors surrounding it".[12]

- "We found that the periodic loading by the MOD-1 [wind turbine]impulses excited a range of structural resonances within the homes measured". [13]

(7) Sound measurements and residents' reactions (diarized) were compared

- "These results, limited as they are, seem to confirm that people do indeed react to a low frequency noise environment and A-weighted measurements are not an adequate indicator of annoyance when low frequencies are dominant". [14]

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[10] *Ibid. p. 112.*
[11] Kelley, 1987, p.1.
[12] Kelley *et al*, 1982, p. 116. Kelley also cites Hubbard, H, & Shepherd, K. "The Helmholtz Resonance Behavior of Single and Multiple Rooms". NASA/CR-178173, Hampton, VA: NASA Langley Research Center (September 1986).
[13] Kelley, 1987, p. 1.
[14] Kelley, 1987, p.6.

(8) A structural pattern differentiates turbine emissions from background noise

- "The acoustic pressure patterns radiated from large wind turbines have a definite structure as compared with the natural, wind-induced background".[15] [IWT emissions are different from background noise.]
- "The acoustic pressure patterns radiated from large wind turbines have a definite structure as compared with the natural, wind-induced background". [16]

(9) Human body resonances associated with annoyance

- "We hypothesize one of the causal factors related to the annoyance associated with the pulsating pressure fields in the rooms measured is a coupling with human body resonances which in turn are responsible for creating the sensation of a whole-body vibration. This perception is more noticeable indoors due to the increased reverberation time and dynamic overpressures from the interaction between the structural and air volume resonances. [17]

- "There is evidence that the strong resonances found in the acoustic pressure field within rooms actually measured indicates a coupling of subaudible energy to human body resonances at 5, 12, and 17-25 Hz, resulting in a sensation of whole-body vibration".[18]

(11) A-weighted measurements inadequately indicate low frequency annoyance

- "A-weighted measurements are not an adequate indicator of annoyance when low frequencies are dominant".[19]

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[15] *Ibid.*
[16] *Ibid.* p. 119.
[17] "From the meager information available from our measurements, we have crudely estimated the perception levels for the body resonance frequencies as 60 dB for 5 Hz, 55 dB for 12 Hz, and 48 dB for the 17-25 Hz band, or +5, 0, and + 10 dB above the existing background for the respective frequencies. Such a process as proposed would explain the perceived annoyance within homes when no perceptable sounds could be heard outdoors". *Ibid.*, p. 119.
[18] *Ibid.* p. 120. See also "Vibrations of 0.5 Hz to 80 Hz have significant effects on the human body", p. 17.
[19] Kelley, 1987, p.6.

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Industry denies wind turbine infrasound emissions

For nearly three decades Kelley's work has been overlooked or intentionally sidestepped. The industry has continued to deny that wind turbines emit infrasound or that it affects nearby residents. In 2009 Robert Hornung of CanWEA misadvised the Ontario Ministry of the Environment:

> "No peer-reviewed study has ever established a link between infrasound from turbines and human health. . .".[20]

In responding to the recent re-discovery of Kelley's research by the public, Australian Clean Energy Council policy director Russell Marsh said the study was not relevant to modern turbines. "This is the equivalent of taking a study about Ataris and applying it to the latest iPads," Mr. Marsh said.

However, the latest much larger wind turbines have been found to emit even more infrasound.

In 2011, Henrik Møller and Christian Pedersen of Aalborg University, Denmark, pointed out that as turbines increase in size, the relative amount of low-frequency noise is greater.

> "It is thus beyond any doubt that the low-frequency part of the spectrum plays an important role in the noise at the neighbors. . . . It must be anticipated that the problems with low-frequency noise will increase with even larger turbines."[21]

---

[20] Letter from Robert Hornung, Canwea to Marcia Wallace, Ministry of the Environment dated July 24, 2009.

[21] "The relative amount of low-frequency noise is higher for large turbines (2.3–3.6 MW) than for small turbines (below 2 MW), and the difference is statistically significant." Moller, H., Pedersen, C.F., "Low-frequency noise from large wind turbines". J. Acoust. Soc. Am. 129 (6), June 2011.

In 2013, acoustician Richard James noted

> ". . . the shifting of the acoustic energy to lower frequencies that has occurred as wind turbines have increased in size from the 1.5 MW models common in 2008 to the 2.5 MW and higher models currently being installed".[22]

He added:

> "Studies by Dr. Neil Kelley demonstrated that low levels of pulsating tonal infrasound caused adverse reactions in test subjects. This research is generally denied by the wind industry and its acoustical experts. In a recent interview, Dr. Kelley now retired from a managerial position at the National Renewable Energy Laboratory (NREL), re-confirmed that the studies he conducted in the 1980's apply to the modern upwind wind turbine designs in use today. He challenged acousticians to install infrasound measurement instruments inside homes if they doubted his opinion".[23]

In the United Kingdom, *"ETSU-R-97"*, a noise guideline document put together in 1997 by the wind industry "noise working group", excludes any reference to the NASA research or to low-frequency noise. It relies exclusively on the dB(A) weighting (found to be irrelevant ten years earlier as a consequence of the NASA research). It assumes that, in all cases, the sound pressure levels inside neighbouring homes are substantially less than what is recorded outside those homes and it neglected the NASA research which showed that inside a house annoyance might be increased when low frequencies are dominant. It excludes testing inside homes for noise of any

[22] James, Richard R. "Opening Statement at hearing re: BluEarth Project, Bull Creek, Alberta". Proceeding Number 1955, 18th November, 2013.
[23] James, R. "Wind Turbine Infra and Low-Frequency Sound: Warning Signs That Were Not Heard". 2012. Bulletin of Science, Technology & Society 32(2) 108–127. DOI: 10.1177/0270467611421845.

frequency.[24] Ontario wind turbine regulations require only dB(A) measurements and do not require LFN or infrasound measurements or noise monitoring inside homes.

The wind industry has opposed all attempts to change standards to include the measurement of low-frequency noise and infrasound or to set controls for low-frequency noise and infrasound inside homes. It has rejected requirements for turbine operators to cooperate in meaningful noise testing by shutting turbines on and off in order to distinguish between the noise generated by turbines and environmental noise. It has refused to provide operational data, such as wind speed and power output data. Instead it has lobbied for higher noise limits to permit larger turbines.

The industry is still determined to keep infrasound measurements out of REA approvals by lobbying environment ministries:

> "CanWEA takes issue with the requirement for infrasound monitoring. . ."
>
> "Studies across the world have shown that turbines do not produce infrasound at levels anywhere near those that can have an impact on humans. . . . CanWEA submits that the proposed requirement for infrasound or low frequency noise monitoring as a condition of the REA be removed". [25]

[24] ETSU-R-97 also establishes methods which allow for the placement of monitoring equipment in locations where high background levels can be recorded prior to construction and subsequently, noise level criteria can be met by simply shifting the location of the monitoring equipment into the open away from trees or bushes—lowering the background levels to allow for wind turbine noise.

[25] CanWEA EBR Posting 010-6516 (Proposed Ministry of the Environment Regulations to Implement the Green Energy and Green Economy Act, 2009) – CanWEA's Supplemental Submission dated July 24, 2009, EBR Comment ID 123788. Signed Robert Hornung President.

Similarly in 2012, the multi-national Denmark-based wind turbine manufacturer, Vestas lobbied the Australian government proposing the removal of the requirement to measure low frequency noise from the Draft Guidelines:

> "Analysis of wind turbine spectra shows that low frequency noise is typically not a significant feature of modern wind turbine noise and is generally less than that of other industrial and environmental sources."
>
> "It is therefore unnecessary to require the prediction and monitoring of low frequency noise emissions from wind turbines".[26]

II. Recent verification of Kelley's work

A test of good science is the ability to repeat the experiment and obtain the same results. In recent years, a number of researchers have carried out studies that relied on full spectrum noise measurements instead of simple A-weighted ones. They have also recognized the importance of placing monitoring equipment *inside* homes rather than only outside. They have identified the pulsating feature of infrasound from wind turbines as a characteristic that allows it to be distinguished from the naturally occurring background infrasound. They have been able to measure infrasound output from turbines and relate it to symptoms experienced by some people living nearby. The harmful effect of wind turbine infrasound on human health—especially its potential to disturb sleep in some individuals—has been investigated; similarly, the negative effect on human health from sleep deprivation has been well documented. The following sections summarize these findings and review three preliminary studies carried out between 2011 and 2015 which validate Dr. Kelley's work. They are followed by a survey of medical research on the adverse effects of infrasound.

[26] Vestas Australian Wind Technology PTY Ltd, letter to New South Wales NSW Department of Planning and Infrastructure dated 14 March 2012.

Malcolm Swinbanks 2012

Swinbanks demonstrated the perception of infrasound at significantly lower levels than has hitherto been acknowledged.

- "Conventional assessments of the perception of infrasound based on mean (rms derived) sound energy levels underestimate the importance of the associated crest factor of very low frequency sound pressure variations".

The results of simulations were compared to independently reported effects which have been observed in laboratory testing by other researchers. [27]

Richard James 2012

In 2012, Richard James published a short article entitled "Wind Turbine Infra and Low-Frequency Sound: Warning Signs That Were Not Heard".[28]

- "There is sufficient research and history to link the sensitivity of some people to inaudible amplitude-modulated infra and low-frequency noise to the type of symptoms described by those living near industrial wind turbines".

- "This information should have served as a warning sign. Experts, some well known in the field of acoustics, have defended the wind industry position through white papers, reports, and

[27] Swinbanks, M. "The Audibility of Low Frequency Wind Turbine Noise". *Fourth International Meeting on Wind Turbine Noise*, Rome Italy, 12-14 April 2011 Inter.Noise USA, 2012.
[28] James R. *Op cit.*

testimony in hearings, and through committees that are establishing guidelines for siting industrial-scale wind turbines.

- "The acoustics profession and individual acousticians should have recognized the early reports of symptoms by people living near wind turbines as a new example of an old problem. Instead of advocating caution in locating wind turbines near people, the rush for renewable energy took precedence. The position or belief that there was little or no possibility inaudible infrasound and very low–frequency noise could be causing the reported problems has delayed further research and the safe implementation of industrial wind turbines.

- "It is the author's opinion that had past experience and information, which was available prior to the widespread implementation of the modern upwind industrial-scale wind turbine, been incorporated into the government and industry guidelines and regulations used to siting wind turbine utilities, many of the complaints and AHEs (adverse health effects) currently reported would have been avoided".[29]

In a newspaper interview he stated:

- "Instead, they have large spikes of (peaks or crests) that are as much as 100 to 1,000 times higher in pressure than the pressure in the valleys between the spikes," said James. "While the average sound pressure level of the tones may not appear to be very significant, it is the peaks of the pressure waves that are significant. . . . Information of this type shows that modern upwind industrial-scale wind turbines can produce significant levels of infrasound and that the sounds produced are a complex mix of tones with rapid modulation patterns. These sounds will likely be more easily perceived than steady pure tones in a laboratory. The potential for dynamically modulated infra and low-frequency sounds to cause AHEs (adverse health effects) has been known for other types of noise sources. There is sufficient infrasound and very low–

[29] *Ibid.*, p. 125.

frequency noise produced by modern wind turbines to warrant caution when locating turbines in communities proximate to residential properties based on the potential for AHEs." [30]

III. Three preliminary studies replicating Kelley's findings

1. The Falmouth Study, December 2011

This investigation is also known as the "Bruce McPherson Infrasound & Low Frequency Noise Study" in honour of the philanthropist who created the private grant "to determine why there were so many strong complaints about the loss of well-being and hardships experienced by people living near large industrial wind turbines operating in Falmouth, Massachusetts".

The chief investigators, Stephen Ambrose and Robert Rand, set out to confirm or deny the presence of infrasonic and low frequency noise emissions (ILFN) from the "WIND 1", a municipally-owned Vestas V82 industrial wind turbine.

However to the surprise of the acousticians, almost immediately upon entering the study area, they themselves succumbed to the same adverse health symptoms that had been described by the people living near large industrial wind turbine sites in the area.

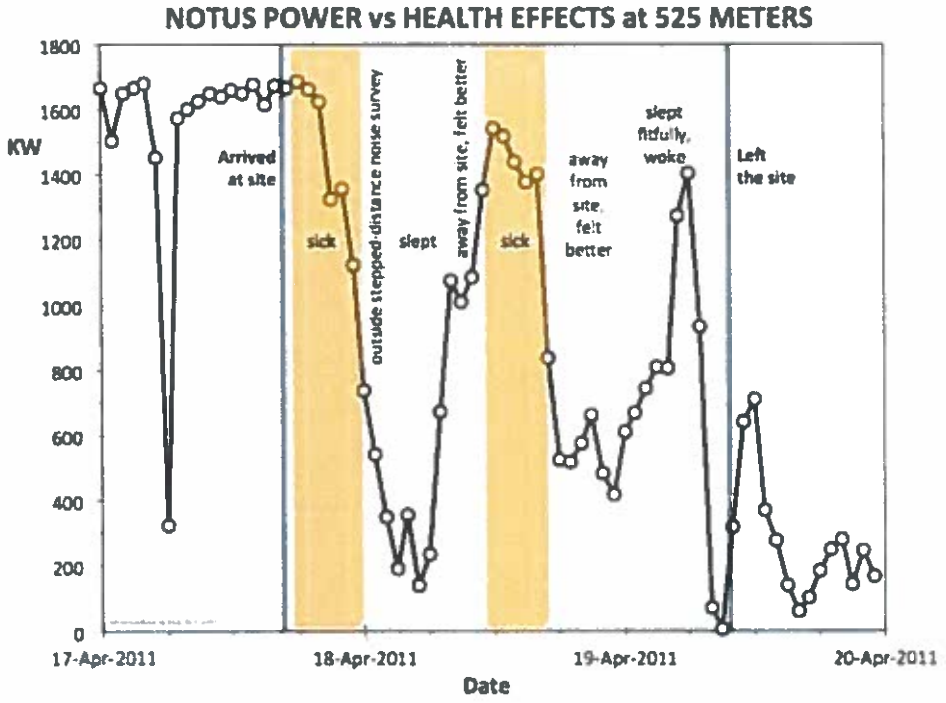
"The onset of adverse health effects was swift, within twenty minutes, and persisted for some time after leaving the study area. The dBA and dBC levels and modulations did not correlate to the health effects experienced. However, the strength and modulation of the un-weighted and dBG-weighted levels increased indoors consistent with worsened health effects experienced indoors. The dBG weighted level appeared to be controlled by in-flow turbulence and exceeded

[30] Rick James. Quoted in *Times News*, Glencoe, Pa, Nov. 17, 2014.

physiological thresholds for response to low-frequency and infrasonic acoustic energy as theorized by Salt".[31]

It took the investigators about a week to recover from the adverse health effects experienced during the study, with lingering recurring nausea and vertigo for almost seven weeks for one of them.

The graph below presents the daily time-history variations in IWT output, observations and physiological symptoms experienced. There is a strong correlation between IWT power output and physiological symptoms.[32]



[31] Ambrose, S, & Rand, R. "The Bruce McPherson Infrasound and Low Frequency Noise Study Adverse Health Effects Produced By Large Industrial Wind Turbines Confirmed", 2011, p.2.
[32] Ambrose, S, Rand, R, Krogh, C. "Falmouth, Massachusetts wind turbine infrasound and low frequency noise measurements", Proceedings of *Inter-Noise 2012*, New York, NY, August 19-22, 2012.

Interestingly, when Ambrose and Rand conducted the Bruce McPherson Study, they were as yet unaware of Kelley's work at the DOE.[33]

The study confirmed Kelley's observation that the LFN causing health problems was inaudible;[34] that sleep disturbance resulted from it;[35] and that infrasound was measured inside the house. The study also affirmed Dr. Kelley's hypothesis of subsequent harmonic coupling of acoustic energy to residential structures.[36] It also re-iterated Kelley's observation that low frequency noise from wind turbines is impulsive:

> "The house envelope blocked most of the frequency content above 10 Hz, and amplified the remaining low frequency pulsations, much like a drum. The acoustic pressure swung from positive (compressed) to negative (rarified) 0.2 Pa peak-to-peak. . . . This increase in modulation indoors was consistent with the stronger adverse health effects Indoors" [37]

> "Our instrumentation reported the Crest Factor at 11-12 dB outdoors and indoors. This suggests that the RMS measurements reported on our graphs are well below the peak levels detectable by the human ear".[38]

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[33] Robert Rand. Personal communication (email) 8 July, 2015.
[34] "The wind turbine tone at 22.9 Hz was not audible yet the modulated amplitudes regularly exceeded vestibular detection thresholds". (Ambrose *et al.*, 2011, p.3)
[35] "Sleep was disturbed during the study when the wind turbine operated with hub height wind speeds above 10 m/s". (*Ibid.*)
[36] "The coherence values indicate that the very-low-frequency energy found below 10 Hz was very strongly coupled into the house interior, consistent with the indoors pressure amplification". *(Ibid., p.40)*
"The 'Indoors' graph shows the house envelope filtered and amplified very low frequency content of the wind turbine sound. What is apparent is that the negative pressure swings (vacuum) are more pronounced indoors compared to outdoors". (*Ibid.)*
[37] *Ibid.*, p. 42.
[38] *Ibid.*, p. 43.

The observation that sensitization occurs as exposure continues may be explained in the fact that

> "It is generally accepted that human response and cumulative effects increase with the quantity and the peak level of intrusive noises. Peak noise events are additive".[39]

Ambrose and Rand emphasized that "the infrasonic and low-frequency pulsations are hidden by the A-weighting filtering normally used by noise consultants to assess noise levels; yet, these pulsations are clearly visible in the linear, un-weighted time history in Pascal". [Pascal is the unit for sound pressure (Pa)][40]

> "The research is more than just suggestive. Our experiencing of the adverse health effects reported by others confirms that industrial wind turbines can produce real discomfort and adverse health impacts. Further research could confirm that these ill effects are caused by pressure pulsations exceeding vestibular thresholds, unrelated to the audible frequency spectrum but are instead related to the response of the vestibular system to the low frequency noise emissions. The vestibular system appears to be stimulated by responding to these pressure pulsations rather than by motion or disease, especially at low ambient sound levels.
>
> "The acoustic energy from the wind turbine was found to be: 1) Greater than or uniquely distinguishable from the ambient background levels, and 2) Capable of exceeding human detection thresholds". [41]

The investigators concluded:

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[39] *Ibid.*, p. 45.
[40] *Ibid.*, p. 43.
[41] *Ibid.*, p. 3.

"This research revealed that persons without a pre-existing sleep deprivation condition, not tied to the location nor invested in the property, can experience within a few minutes the same debilitating health effects described and testified to by neighbors living near the wind turbines. The debilitating health effects were judged to be visceral (proceeding from instinct, not intellect) and related to as yet unidentified discordant physical inputs or stimulation to the vestibular system. Health effects moderated when dBG levels fell well below the 60 dBG guideline when the wind turbine was OFF".[42]

2. Shirley, Brown County, Wisconsin, 2012

The investigation of the Shirley wind project was carried out co-operatively by four different acoustic firms. They concluded:

"The four investigating firms are of the opinion that enough evidence and hypotheses have been given herein to classify LFN and infrasound as a serious issue, possibly affecting the future of the industry. It should be addressed beyond the present practice of showing that wind turbine levels are magnitudes below the threshold of hearing at low frequencies"[43]

"This cooperative effort has made a good start in quantifying low frequency and infrasound from wind turbines. Unequivocal measurements at the closest residence R2 [Residence 2] are detailed . . . showing that wind turbine noise is present outside and inside the residence. Any mechanical device has a unique frequency spectrum, and a wind turbine is simply a very large fan and the blade passing frequency is easily calculated by RPM/60 x the number of blades, and for this case; 14 RPM/60 x 3 = 0.7 Hz. The next six harmonics are 1.4, 2.1, 2.8, 3.5, 4.2 & 4.9

[42] *Ibid.*, pp. 46-47.
[43] Walker, B., Hessler, G., Hessler, D, Rand, R. & Schomer, P. "A Cooperative Measurement Survey and Analysis of Low Frequency and Infrasound at the Shirley Wind Farm in Brown County, Wisconsin". Report Number 122412-1 Issued: December 24, 2012, p. 167.

Hz and are clearly evident . . . . Note also there is higher infrasound and LFN inside the residence in the range of 15 to 30 Hz that is attributable to the natural flexibility of typical home construction walls.[44]

Robert Rand reported ill effects (headache and/or nausea while testing and severe effects for 3+ days after testing.

Dr. Paul Schomer was one of the investigating acousticians on the Shirley project. In his report which was attached as Appendix D to the main Wisconsin report, he outlined the implications of the measurements of the Shirley Wind Farm:

- "At most locations where these health problems occurred, the wind turbines were generally not audible. That is, these health problems are devoid of noise problems and concomitant noise annoyance issues".

- "Residents of the nearest house reported that their baby son, now 2 years old, would wake up 4 times a night screaming. This totally stopped upon their leaving the vicinity of the wind turbines, and he now sleeps 8 hours and awakens happy. The fact that these residents largely report wind turbines as inaudible, and the reported effects on a baby seem to rule out the illness being caused by extreme annoyance as some have suggested".

- "In Implications, it is inferred from the resident observations that the important effects result from very low frequency infrasound, about 3 Hz or lower".

- "The measurements support the hypothesis developed in that the primary frequencies are very low, in the range of several tenths of a Hertz up to several Hertz. The coherence analysis shows

[44] *Ibid.*, p.6.

that only the very low frequencies appear throughout the house and are clearly related to the blade passage frequency of the turbine".[45]

- "The house is acting like a cavity and indeed at 5Hz and below, where the wave length is 200 ft or greater, the house is small compared to the wave length". [46]

- "Currently the wind turbine industry presents only A-weighted octave band data down to 31 Hz, or frequently 63 Hz, as a minimum. They have stated that the wind turbines do not produce low frequency sound energies. The measurements at Shirley have clearly shown that low frequency infrasound is clearly present and relevant. A-weighting is inadequate and inappropriate for description of this infrasound. . . . The International Electro-technical Commission (IEC) Wind Turbine measurement standard needs to include both infrasonic measurements and a standard for the instruments by which they are measured."

On October 14, 2014, the Brown County Board of Health declared the Shirley Wind Turbine Development "a Human Health Hazard for all people (residents, workers, visitors, and sensitive passersby) who are exposed to Infrasound/Low Frequency Noise and other emissions potentially harmful to human health."[47]

3. Cooper: Cape Bridgewater 2014

Acoustician Steve Cooper's study "The Results of an Acoustic Testing Program, Cape Bridgewater Wind Farm" (26 November 2014)[48] was similar to Kelley's project at

[45] *Ibid.*, Appendix D by Schomer and Associates Inc.
[46] Walker *et al.*, p.7.
[47] Brown County Code 38.01 , Brown County Ordinances, Chapter 38, relating to Public Health Nuisance (section (b) Human Health Hazard): "a substance, activity or condition that is known to have the potential to cause acute or chronic illness or death if exposure to the substance, activity or condition if not abated".
[48] Cooper, S. "The Results of an Acoustic Testing Program, Cape Bridgewater Wind Farm, 44.5100.R7:MSC". Prepared for Energy Pacific (Vic) Pty Ltd, Melbourne, Vic., 26 November, 2014.

Boone in that he had been called in by the turbine operator, Pacific Hydro, to investigate noise complaints at three houses without restriction and with the co-operation of the wind turbine operator and the local residents. Monitoring both inside and outside of homes was completed over nine weeks using both internal and external locations, including a number of nights inside peoples' homes. The wind turbines were shut down for part of the time in order to carry out maintenance work on cables. It determined "the actual physical parameters involved in the measurement, interpretation and assessment of wind farm noise (audible and infrasound) on persons" in 235 pages with 6 technical annexures (491 pages). It identified infrasound "as a standard and normal part of the emissions of a wind farm. The character of the infrasonic emissions is identified as being measurably different from 'ordinary' wind; that is, infrasound generated by/from turbines consists of trains of pressure pulses and must be measured through narrow-band analysis and interpreted accordingly. Standard measures with third-octave bands and G-weighting are found to be not valid identifiers/measures of wind turbine affected wind noise".[49]

Using the diarized residents' one to two hourly observations when they felt well and when they didn't, the study identified 'sensation' (including headache, pressure in the head, ears or chest, ringing in the ears, heart racing, or a sensation of heaviness) as the major form of disturbance from the wind farm.

It also found a trend between high levels of disturbance (severity of "sensation") and changes in the operating power of the wind farm.

The study identified that the infrasound inside the houses was subaudible. Using narrow band analysis in the infrasound region "the measurement results clearly show a *periodic pattern in the infrasound* (the wind turbine signature) whilst the natural

[49] Letter from Bob Thorne to Steve Cooper, 21 January, 2014.

environment for infrasound has no such periodic patterns".[50] Cooper called this the WTS (Wind Turbine Signature) which is not present when the turbines are shut down. Like Kelley, he observed that the WTS is characterized by modulation. By including narrowband analysis in the description of the acoustic environment, the study confirms that the infrasound obtained in a wind farm affected environment is different to that in a natural acoustic environment.

- "When placed in the concept of a dB(WTS) curve, there is agreement with the infrasound components of the turbine perception nominated by Kelly in 1982".[51]

- "In medical studies, the dB(A) level measurement inside dwellings is of no assistance in such studies. . . . The use of dB(A) for the assessment of large industrial wind turbines does not address low frequency noise (LFN) or infrasound due to the filter characteristics of the A-weighting curve".[52]

- "Investigations into the infrasound issue associated with the wind turbines also require consideration of the noise levels inside buildings. In some cases the internal noise levels are higher than external, whilst for other sites the internal levels are marginally below that recorded externally – but not to the extent as the reduction in dB(A) values".[53]

He found as Kelley had, from testing inside buildings that

- "Due to building elements having an attenuation at low-frequencies much lower than that of high frequencies, the external spectra from outside a dwelling changes in its spectral shape when measured inside a dwelling, such that where there is a broadband noise outside then

[50] *Ibid., p. 215.*
[51] *Ibid.*, p. v.
[52] *Ibid.*, p. 220.
[53] *Ibid.*

inside the dwelling the noise becomes predominantly a low frequency noise by the elimination of mid and high frequency components".[54]

Monitoring during the shutdown period

". . . permitted the opportunity to obtain noise data of the natural environment under various wind conditions, which would not be available during normal operations because of the operation of the turbines. The residents' observations during the shutdown periods identify there was no appreciable impact in terms of noise, vibration or sensation inside the buildings or the external yard area".[55]

The shutdown also allowed Cooper to make the same differentiation Kelley had between the characteristics of the infrasound emitted by the wind turbine (called the Wind Turbine Signature-- WTS) and the naturally occurring background infrasound.

"Utilizing the Cape Bridgewater narrow band results superimposed onto the 1/3 octave band results shows there is a difference between the natural environment and a wind farm affected environment in the infrasound region. Therefore one cannot claim that infrasound levels in the natural environment are similar to that of wind farm affected environments."[56]

The unique infrasound 'wind turbine signature', was found to be present in the homes, and linked it to the diarized 'sensations' felt by the residents.

"When placed in the concept of a dB(WTS) curve, there is agreement with the infrasound components of the turbine perception nominated by Kelley in 1982".[57]

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[54] *Ibid.*, p. 46.
[55] *Ibid.*, p. 53.
[56] *Ibid.*, p. 197.
[57] *Ibid.*, p v.

In February, 2015, Dr. Paul Schomer wrote of the Bridgewater report:

"This study finds that these 6 people sense the operation of the turbine(s) via other pathways than hearing or seeing, and that the adverse reactions to the operations of the wind turbine(s) correlates directly with the power output of the wind turbine(s) and fairly large changes in power output.

Attempts may be made to obfuscate these simple points with such arguments as it cannot be proved that infra-sound is the cause of the discomfort. But that again is a specious argument. The important point here is that something is coming from the wind turbines to affect these people and that something increases or decreases as the power output of the turbine increases or decreases. Denying infra-sound as the agent accomplishes nothing. It really does not matter what the pathway is, whether it is infra-sound or some new form of rays or electro-magnetic field coming off the turbine blades. If the turbines are the cause, then the windfarm is responsible and needs to fix it. Anyone who truly doubts the results should want to replicate this study using independent acoustical consultants at some other wind farm, such as Shirley Wisconsin, USA, where there are residents who are self-selected as being very or extremely sensitive to wind turbine acoustic emissions".[58]

"Some may ask, this is only 6 people, why is it so important? The answer is that up until now windfarm operators have said there are no known cause and effect relations between windfarm emissions and the response of people living in the vicinity of the windfarm other than those related to visual and/or audible stimuli, and these lead to some flicker which is treated, and 'some annoyance with noise.' This study proves that there are other pathways that affect some people, at least 6. The windfarm operator simply cannot say there are no known effects and no known people affected. One person affected is a lot more than none; the existence of just one cause-and-effect

[58] Schomer, P. "The Results of an Acoustic Testing Program, Cape Bridgewater Wind Farm Prepared for Energy Pacific by Steve Cooper, The Acoustic Group
A Review of this Study and Where It Is Leading". 10 February, 2015.

pathway is a lot more than none. It only takes one example to prove that a broad assertion is not true, and that is the case here. Windfarms will be in the position where they must say: 'We may affect some people.' And regulators charged with protecting the health and welfare of the citizenry will not be able to say they know of no adverse effects. Rather, if they choose to support the windfarm, they will do so knowing that they may not be protecting the health and welfare of all the citizenry".[59]

Stephen Ambrose observed that the correlation of human response journal entries with scientific waveform analysis in the Bridgewater study clearly shows hearing is not limited to audible sounds and that it goes far beyond the 1980s Neil Kelley et al. studies that identified operating wind-turbines can produce airborne transmissions that humans detect as "sensations".[60]

IV. Medical evidence on chronic infrasound exposure

World Health Organization: concerns about low frequency noise exposure

The 1999 World Health Organization (WHO) report "Guidelines for Community Noise" makes the following observations:

- "It should be noted that a large proportion of low-frequency component in a noise may increase considerably the adverse effects on health".[61]

- "The evidence on low frequency noise is sufficiently strong to warrant immediate concern".[62]

[59] Schomer, P. "Further comments on the Cape Bridgewater Wind Farm Study--Muddying the waters The Cooper report on the Cape Bridgewater Wind Farm. 2015.
[60] Stephen Ambrose letter to Steve Cooper dated January 22, 2015.
[61] Berglund, B, Lindvall, T, and Schwela, D, Ed. "Guidelines for Community Noise". World Health Organization, Geneva, 2000, p. xiv.
[62] *Ibid.*, p.35.

- "It should be noted that low-frequency noise . . . can disturb rest and sleep even at low sound pressure levels".[63]

- "Other primary physiological effects can also be induced by noise during sleep, including increased blood pressure; increased heart rate; … vasoconstriction; …cardiac arrhythmia".[64]

- "Special attention should also be given to the following considerations: . . .
  c. Sources with low-frequency components. [Sleep] disturbances may occur even though the sound pressure level during exposure is below 30 dBA".[65]

- "After prolonged exposure, susceptible individuals in the general population may develop permanent effects, such as hypertension and ischaemic heart disease. . .".[66]

- "For noise with a large proportion of low frequency sounds a still lower guideline (than 30dBA) is recommended."

- " When prominent low frequency components are present, noise measures based on A-weighting are inappropriate."

The DEFRA Report, 2003

"A Review of Published Research on Low Frequency Noise and its Effects" by Leventhall *et al.* published by DEFRA in 2003, stated:

[63] *Ibid.*, p. xii.
[64] *Ibid.*, p. x.
[65] *Ibid.*, p. 28.
[66] *Ibid.* p. x. See Babisch 1998 a; Babisch 1998b; Babisch et al. 1999; and Thompson, 1996.

- "The effects of infrasound or low frequency noise are of particular concern because of its pervasiveness due to numerous sources, efficient propagation, and reduced efficiency of many structures (dwellings, walls, and hearing protection) in attenuating low frequency noise compared with other noise".[67]

- "Exposure to low frequency noise in the home at night causes loss of sleep". [68]

In the 2003 DEFRA report he noted:

- "It is possible that body organs resonate within the low frequency range. Complainants of low frequency noise sometimes report a feeling of vibrations through their body".[69]

Citing the work of Inukai *et al.*, (2000) and Nakamura and Inukai, (1998), Leventhall noted that there are

> "four main subjective factors in response to low frequency noise: auditory perception, pressure on the eardrum, perception through the chest and more general feeling of vibration".[70]

His report concluded:

- "There is no doubt that some humans exposed to infrasound experience abnormal ear, CNS, and resonance induced symptoms that are real and stressful. If this is not recognised by investigators or their treating physicians, and properly addressed with understanding and

[67] Leventhall, G, Pelmear, P, & Benton, S. "A Review of Published Research on Low Frequency Noise and its Effects Report for Defra". Published by the Department for Environment, Food and Rural Affairs, (DEFRA), May, 2003, p. 54.
[68] Leventhall *et al* DEFRA review, p. 54.
[69] Leventhall, G, Brown, F, and Kyriakides, K. " Somatic responses to low frequency noise". *Proc ICA*, Madrid, 1977.
[70] Leventhall *et al* DEFRA review, p. 32.

sympathy, a psychological reaction will follow and the patient's problems will be compounded".[71]

Vibrations of 0.5 Hz to 80 Hz have significant effects on the human body

As pointed out by Professor Alan Hedge, of Cornell University,

"every object (or mass) has a resonant frequency. When an object is vibrated at its resonance frequency, the maximum amplitude of its vibration will be greater than the original amplitude (i.e. the vibration is amplified). Vibrations in the frequency range of 0.5 Hz to 80 Hz have significant effects on the human body".

"Individual body members and organs have their own resonant frequencies and do not vibrate as a single mass, with its own natural frequency. This causes amplification or attenuation of input vibrations by certain parts of the body due to their own resonant frequencies. Vibrations between 2.5 and 5 Hz generate strong resonance in the vertebra of the neck and lumbar region with amplification of up to 240%. Vibrations between 4 and 6 Hz set up resonances in the trunk with amplification of up to 200%. Vibrations between 20 and 30 Hz set up the strongest resonance between the head and shoulders with amplification of up to 350%.

Whole body vibration may create chronic stresses and sometimes even permanent damage to the affected organs or body parts".

ISO 2631 (International Organization for Standardization) Human Response to Whole Body Vibration (WVB) (parts 1, 2, and 4) sets limits to the maximum possible exposure allowed for whole-body vibration including 'severe discomfort boundaries' for 8-hour, 2-hour and 30-minute WBV exposures in the 0.1 Hz to 0.63 Hz range.

[71] *Ibid.*, p.60.

> "The exposure limit is the lowest for frequencies between 4-8 Hz because the human body is most sensitive to WBV at these frequencies. Suspected health effects of whole body vibration include: blurred vision; decrease in manual coordination; drowsiness (even with proper rest); low back pain/injury; insomnia".[72]

In 2006 Leventhall commented that "fluctuating audible sounds or amplitude modulations are the routine characteristic of IWTs and may be disturbing and stressful to exposed individuals".[73]

At a public hearing in Wisconsin in 2009[74], Leventhall stated that he was happy to accept the symptoms reported by individuals living near wind turbines including sleep disturbance, headache, tinnitus, ear pressure, dizziness, vertigo, nausea, visual blurring, tachycardia, irritability, problems with concentration and memory, and panic episodes associated with sensations of internal pulsation or quivering when awake or asleep, "as they have been known to me for many years as the symptoms of extreme psychological stress from environmental noise, particularly low frequency noise".[75]

How sleep disturbance undermines health

In a 2014 article in the Lancet, Basner *et al.* confirmed:

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[72] Hedge, A. "Notes for students", Department of Department of Design and Environmental Analysis, Cornell University. (http://ergo.human.cornell.edu/studentdownloads/dea3500pdfs/whole-bodyvi), p.2-3.

[73] Leventhall, G. "Infrasound from wind turbines: Fact, fiction or deception?" *Canadian Acoustics, 34,* 29-36, 2006.

[74] Leventhall, G. "Wind turbine syndrome: An appraisal *Hearing before the Public Service Commission of Wisconsin*", 2009.

[75] However, in spite of these earlier statements, Professor Leventhall has subsequently appeared as an expert witness in various court proceedings for wind developers. Leventhall's evidence asserting that the nocebo effect was causing the reported symptoms was most recently heard in the Bull Creek case before the Alberta Utilities Commission in November, 2013. Rick James has observed: "The studies and reports by acousticians not affiliated with or sponsored by the wind industry warrant substantially more weight because they are less subject to issues of 'group think' or confirmation bias".

- "Evidence of the non-auditory effects of environmental noise exposure on public health is growing. Observational and experimental studies have shown that noise exposure leads to annoyance, disturbs sleep and causes daytime sleepiness, affects patient outcomes and staff performance in hospitals, increases the occurrence of hypertension and cardiovascular disease, and impairs cognitive performance in schoolchildren".[76]

  "Sleep disturbance is thought to be the most deleterious non-auditory effect of environmental noise exposure . . . because undisturbed sleep of a sufficient length is needed for daytime alertness and performance, quality of life, and health. Human beings perceive, evaluate, and react to environmental sounds, even while asleep".[77]

  "Taken together, the present review provides evidence that noise not only causes annoyance, sleep disturbance, or reductions in quality of life, but also contributes to a higher prevalence of the most important cardiovascular risk factor arterial hypertension and the incidence of cardiovascular diseases. The evidence supporting such contention is based on an established rationale supported by experimental laboratory and observational field studies, and a number of epidemiological studies. Meta-analyses have been carried out to derive exposure–response relationships that can be used for quantitative health impact assessments. Noise-induced sleep disturbance constitutes an important mechanism on the pathway from chronic noise exposure to the development of adverse health effects. [78]

[76] Basner, M, Babisch, W, Davis, A, Brink, M, Clark, C, Janssen, S, Stansfeld, S. "Auditory and non-auditory effects of noise on health. *Lancet* 2014; 383: 1325–32

[77] Basner, *et al.* "Cardiovascular effects of environmental noise exposure". *Noise literature review 2011-2014, 835.*

[78] Münzel, T, Gori, T, Babisch, W, and Basner, M. "Cardiovascular effects of environmental noise exposure". *European Heart Journal* (2014) 35, 829–836.

How subaudible infrasound is perceived in humans

In 2004, H. Møller and C. S. Pedersen[79] of the Department of Acoustics, Aalborg University wrote and article on "Hearing at Low and Infrasonic Frequencies":

- "The ear is the primary organ for sensing infrasound . . . the perceived character of a sound that changes with decreasing frequency. Pure tones become gradually less continuous, the tonal sensation ceases around 20 Hz, and below 10 Hz it is possible to perceive the single cycles of the sound. A sensation of pressure at the eardrums also occurs. The dynamic range of the auditory system decreases with decreasing frequency".

- "The hearing becomes gradually less sensitive for decreasing frequency, but there is no specific frequency at which the hearing stops. Despite the general understanding that infrasound is inaudible, humans can perceive sound also below 20 Hz. This applies to all humans with a normal hearing organ, and not just to a few persons. The perceived character of the sound changes gradually with frequency. For pure tones the tonal character and the sensation of pitch decrease with decreasing frequency, and they both cease around 20 Hz. Below this frequency tones are perceived as discontinuous. From around 10 Hz and lower it is possible to follow and count the single cycles of the tone, and the perception changes into a sensation of pressure at the ears. At levels 20-25 dB above threshold it is possible to feel vibrations in various parts of the body, e.g. the lumbar, buttock, thigh and calf regions".[80]

- "A feeling of pressure may occur in the upper part of the chest and the throat region. Spontaneous reactions from subjects and visitors in the author's laboratory as well as their own

[79] Møller, H & Pedersen, C. "Hearing at Low and Infrasonic Frequencies". Department of Acoustics, Aalborg University, 2004, P. 54.
[80] *Ibid.* pp. 54-55.

experience suggest that vibrotactile sensations and a feeling of pressure may also occur in the upper part of the chest and in the throat region".[81]

- "It has also been shown that the hearing threshold may have a microstructure that causes a person to be especially sensitive at certain frequencies. These two phenomena may explain observations from case studies, where individuals seem to be annoyed by sound that is far below the normal threshold of hearing".

- "In addition to direct detection, infrasound may be detected through amplitude modulation of sound at higher frequencies. This modulation is caused by the movement of the eardrum and middle-ear bones induced by the infrasound, which results in changes of transmission properties. . . . a sound, which is inaudible to some people, may be loud to others. There is a reasonable agreement between data also below this frequency, and contours have been proposed down to 2 Hz".[82]

- "Under certain atmospheric conditions, e.g., temperature inversion, the noise may be more annoying and—in particular the low-frequency part—propagate much further than usually assumed". [83]

In a 7-year study that collected acoustic data at a number of the homes, so that cumulative acoustic exposures for some study participants could then be estimated, Robert Thorne concluded:[84]

[81] Møller & Pedersen *op. cit.* p. 50
[82] *Ibid.* p. 55.
[83] Møller, H, Pedersen, C. "Low-frequency wind-turbine noise". *J. Acoust. Soc. Am.*, Vol. 129, No. 6, June 2011, p. 3743.
[84] Thorne, R. "Wind Farm Noise and Human Perception A Review". Noise Measurement Services, Pty. Ltd, Queensland, Australia, 2013, p. 92.

- "The findings suggest that the individuals living near the wind farms of this study have a degraded Health-Related Quality of Life through annoyance and sleep disruption and that their health is significantly and seriously adversely affected (harmed) by noise. Based on the results of the study it is argued that, when exposed to wind farm noise and wind turbine generated air pressure variations, some individuals will more likely than not be so affected that there is a known risk of serious harm (also termed 'significant adverse effect') to health."

Nissenbaum & Hanning

In 2012, two medical doctors[85] published in a peer reviewed journal, the findings of their stratified cross-sectional study involving the health effects of persons living within 1100 meters of the Vinylhaven and Mars Hill Wind Turbine Projects in Aroostook County, Maine, which consists of 28 wind turbines.[86] They also presented their research at the 10th International Congress on Noise as a Public Health Problem (ICBEN) 2011, London, UK. They concluded:

"The noise emissions of IWTs disturbed the sleep and caused daytime sleepiness and impaired mental health in residents living within 1.4 km of the two IWT installations studied. Industrial wind turbine noise is a further source of environmental noise, with the potential to harm human health. Current regulations seem to be insufficient to adequately protect the human population living close to IWTs. Our research suggests that adverse effects are observed at distances even beyond 1 km. Further research is needed to determine at what distances risks become negligable, as well as to better estimate the portion of the population suffering from adverse effects at a given distance".

[85] Michael Nissenbaum MD, Northern Maine Medical Center, Fort Kent, Maine, USA and Christopher Hanning, MB, BS, MD, University Hospitals of Leicester, Leicester, UK.
[86] Nissenbaum, M, Aramini, J, Hanning, D. "Effects of industrial wind turbine noise on sleep and health". *Noise and Health International Journal*, September-October 2012.

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In a sworn affidavit before the Court of Queen's Bench Judicial Centre of Saskatoon, Saskatchewan, Dr Nissenbaum stated:

> "It is my professional opinion that there is a high probability of significant adverse health effects for those whose residence is located within 1100 meters of a 1.5 MW turbine installation based upon the experiences of the subject group of individuals living in Mars Hill, Maine. It is my professional opinion, based on the basic medical principle of having the exposure to a substance proven noxious at a given dose before risking an additional exposure, that significant risk of adverse health effects are likely to occur in a significant subset of people out to at least 2000 meters away from an industrial wind turbine installation. These health concerns include:
>
> - Sleep disturbances/sleep deprivation and the multiple illnesses that cascade from chronic sleep disturbance.
> - These include cardiovascular diseases mediated by chronically increased levels of stress hormones, weight changed, and metabolic disturbances including the continuum of impaired glucose tolerance up to diabetes.
> - Psychological stresses which can result in additional effects including cardiovascular disease, chronic depression, anger, and other psychiatric symptomatology.
> - Increased headaches.
> - Unintentional adverse changes in weight.
> - Auditory and vestibular system disturbances.
> - Increased requirement for and use of prescription medication".

Summing up by a medical doctor and sleep specialist

Dr. Christopher Hanning BSc, MB, BS, MRCS, LRCP, FRCA, MD has served as Director of the Sleep Clinic and Laboratory at Leicester General Hospital, one of the largest sleep

disorders clinics in the UK.[87] In 2013 he presented the following evidence under oath to the Alberta Utilities Commission Hearing for the Bull Creek wind development.

His opening statement provides an appropriate summary of the medical evidence[88]:

> "I do not think that there is any dispute that adequate sleep is essential for human health and well being. There is a vast literature on the effects of sleep loss on brain function, the heart and circulation, metabolism to name but a few. Anything that causes sleep loss will lead to ill health.
>
> "I do not think that there is any dispute either that wind turbine noise emissions can disturb sleep and that this is the principle reason for requiring a separation distance between turbines and homes. The separation distance is determined either as an actual minimum distance or by reference to a calculated noise level that has been deemed to be acceptable. The acceptable noise level is derived from a variety of sources, in particular studies of the effects of traffic noise. It must be remembered that the acceptable noise levels used in regulations and guidelines relating to wind turbines have only been derived from theoretical considerations and not from experiment at actual wind turbine sites with actual people. Until recently, there has been no experimental verification that the recommended noise levels are in fact safe and have no discernable impact on human sleep.

[87] He has served as first Honorary Secretary of the British Sleep Society; Chairman of the Primary Care Sleep Group; Examiner Part II (Primary) FRCA Examination; Regional Adviser to the Royal College of Anaesthetists; Member, Royal College of Anaesthetists Advisory Appointments Committee Panel; Member, Royal College of Anaesthetists Hospital Accreditation Panel; Chairman, Independent Research Ethics Committee, PPD Pharmaco; Medical Adviser, UK Narcolepsy Association; and Chairman and Panellist, General Medical Council, Fitness to Practice Panels.

[88] Opening Statement of Dr Christopher Hanning BSc, MB, BS, MRCS, LRCP, FRCA, MD. Alberta Utilities Commission Hearing for development of wind power plant and associated substation in the Provost area ("Bull Creek"). Proceeding Number 1955 18th November 2013.

"In my expert opinion, there is now more than sufficient evidence to conclude that wind turbine noise impairs the sleep and health of residents living at distances greater than those proposed in the project under consideration. There is a real risk to the sleep and health of any resident living within 1.5km of a turbine. I base this opinion on three main strands of evidence.

"First, the anecdotal evidence. Dr Phillips has dealt with this so I will not deal with further with it except to state that I find it convincing. Secondly, the various general surveys taken around wind turbine installations including those of Pedersen and van den Berg in Europe and more recently by Morris and Schneider in Australia, all of which point to problems with sleep but did not use any specific test instruments for sleep quality. Again, I find the weight of evidence convincing as it all points in the same direction.

Thirdly, those studies that have used control groups and specific test instruments for sleep. Dr Shepherd's peer-reviewed study used the WHO Quality of Life test instrument which includes elements related to sleep and shows unequivocally that those living within about 1.4km of the turbines had a lower quality of life than those living several kilometres away. Dr Nissenbaum's peer-reviewed study, to which I contributed and am an author, showed convincingly that those living within about 1.5km of wind turbines had worse sleep than those living several kilometres away. This study looked at two different wind turbine facilities.

"Dr Bigelow's study, sponsored by the Ontario Government at 8 wind turbine sites, used similar sleep specific test instruments to the Nissenbaum study. The results are very similar and confirm that the closer one lives to a wind turbine installation, the more likely you are to have poor sleep. This study is complete and the results have been presented as a poster. Dr Ollson has, most unfairly, characterised this as a student study. It is not. The poster presents the results of the largest study thus far to examine the effects of wind turbine noise on sleep using test instruments specific for sleep conducted by experienced investigators who consulted widely in designing the study including with myself. BluEarth's [the developer's] witnesses claim that

there is insufficient evidence to prove a causal link between wind turbine noise and sleep disruption. The only study of wind turbine noise and well being which does not demonstrate harm is that of Mroczek. The study group included subjects not exposed to turbine noise and the conclusions are not justified by the data. Every other study shows harm. There is no single, well conducted, controlled and reliable piece of original research which shows that wind turbines do not cause harm at the distances proposed here. Not one.

"With respect to causality, affected subjects improve when exposure ceases and relapse when exposure restarts. This is prima facie evidence of causality. The studies of Pedersen as well as those of Nissenbaum and Bigelow show a clear dose-response relationship. This too is prima facie evidence of causality.

"I am not a lawyer but my work with the United Kingdom General Medical Council gives me a good understanding of standards of proof. In a situation such as this where the consequence of the wrong decision is highly likely to be harm to the nearby residents, the civil standard of proof is appropriate, the balance of probabilities. In my expert opinion, the scientific evidence more than meets this evidentiary test.

"Wind turbine noise from turbines of the size proposed in the project under consideration has a high risk of disturbing the sleep and impairing the health of those living within 1.5km. There are at least 25 occupied properties meeting this criterion and I advise that the proposal be refused to safeguard the occupants".

Conclusion

Based on the information presented above, infrasound generated by wind turbines must be considered a potential direct cause of the adverse health reactions widely reported from wind turbine host communities.

Now that so many indicators point to infrasound as a potential agent of adverse health effects, it is critical to re-examine the approach to this aspect of wind turbine operation, revise regulations, and immediately implement protective public health measures based on the precautionary principle.

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ABOUT THE AUTHOR

Keith Stelling is an independent researcher and writer with many articles on health issues published in Canada and the United Kingdom.

After graduating from McMaster University with an Honours B.A. and M.A., he completed three years of post graduate studies at the School of Phytotherapy in England, obtaining the Diploma in Phytotherapy and becoming the first Canadian member of the National Institute of Medical Herbalists of Great Britain and the College of Practitioners of Phytotherapy (England). After returning to Ontario he taught courses, ran his own practice and founded and edited the Canadian Journal of Herbalism. He also served as a peer reviewer on the editorial board of the British Journal of Phytotherapy, and as a member of the Government of Canada Second Expert Advisory Committee on Herbs and Botanical Preparations, presented to the House of Commons Standing Committee on Health, and contributed a number of monographs to the Canadian Pharmacists Association and the Canadian Medical Association guide to botanical medicine (Chandler F, editor. 2000. "Herbs: Everyday Reference for Health Professionals").

After retiring to rural Bruce County, he became aware of the health and environmental issues associated with nearby wind turbines and has spent the last nine years researching these concerns. He was appointed a citizen member of the Multi-municipal Wind Turbine Working Group comprised of elected municipal councillors from Bruce, Grey, and Huron Counties. He was a founding member of Wind Concerns Ontario and in 2008 he formed a local conservation group, "The Friends of Arran Lake" with the aim of preventing the significant wildlife habitat in his neighbourhood from being degraded by a wind turbine development.

His research papers include:

Stelling, Keith (2012). **"Questions arising from the Auditor General's 2011 Report on Renewable Energy Initiatives".** With comprehensive and detailed evidence gathered independently from inside the Ministry of Energy– much of it previously unavailable to the public– the Auditor General's Report unambiguously challenges both the rationale and implementation of the Green Energy Act. The Act has been promoted as a mechanism for cutting greenhouse gas emissions, increasing job opportunities, and creating a competitive business environment. However the Auditor General's investigators found little evidence that these objectives have been or would be realized.
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survival or reduced breeding productivity-- a particular concern for declining populations. The cumulative effects of multiple on- and off-shore wind developments have not been considered. Download original document: "Threats from industrial wind turbines to Ontario's wildlife and biodiversity"

Stelling, Keith (2010). **"What went wrong with Ontario's energy policy? Comparing spin and reality".** By referring to the economic experience of those European countries that have vigorously promoted wind energy over the last two decades, this report demonstrates that the decisions of the Ontario government did not take into consideration the reality of introducing large scale industrial wind energy onto the grid. In fact, the government's enthusiasm to embrace what it claimed to be cheap, "clean", environmentally benign electricity at the same time as diminishing CO2 emissions appears to have ignored all the realistic warnings from electricity production professionals it received. (*Predictions of rising electricity costs and job losses have become reality with Ontario having the highest electricity costs in North America).* Download original document: "What went wrong with Ontario's energy policy?"

Stelling, Keith and Krogh, Carmen (2009). **"Summary of Recent Research on Adverse Health Effects of Wind Turbines".** Authorities and politicians in Ontario have been repeatedly warned that industrial wind turbines are having an adverse effect on the health of those living nearby. Health complaints are not peculiar to this province but are consistent throughout the world wherever large industrial wind turbines have been installed. Contrary to the claims of the industry, there is a growing body of peer-reviewed research substantiating these health claims. This report attempts to catalogue the most recent. *A generally acknowledged major concern about wind turbine disturbance centres around the low frequency noise projected from this heavy industrial machinery. Until recently measurements of this type of noise have seldom been carried out near wind turbines. There is already ample scientific evidence that low frequency noise is a cause of sleep disturbance in humans.* The evidence also suggests that long term exposure normally leads to serious health problems. *Research on animals indicates that basic survival functions such as hunting, self protection and reproduction are interrupted by low frequency noise exposure.* Download original document: "Adverse Health Effects of Wind Turbines"

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An information update for Ontario Electricity Consumers Studies challenging the assumption upon which the ecological value of commercial wind power is based: that it does not reduce carbon emissions because it requires fossil-fuelled back up; that wind energy is not cheap but very expensive and will raise consumer electricity costs to economically destructive levels. Download original document: "Calculating the Real Cost of Industrial Wind Power"

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